Comparative Study of Steam Injection Effects on Operation of Gas Turbine Cycles

Hany. A. M. Beblawy

Abstract:

Gas turbine cycle technologies will play a major role in future power generation and several well-justified concepts have been developed or are the subject of major feasibility studies. In the present work, gas turbine cycles are modified with steam injection between the combustion chamber exit and the gas turbine inlet. Heat recovery steam generators, utilizing the exhaust gases, provide these cycles with the injected steam at saturated vapor. The thermodynamic characteristics of the various cycles are considered in order to establish their relative importance to future power generation markets. The irreversibility of the different composing units of the cycles and the variation of gas properties due to steam injection as well as changes in the interrelation of component performance parameters are taken into account. The isentropic temperature ratio and maximum to minimum cycle temperature ratio are varied over some ranges that slightly exceed their practically acceptable bounds in order to comprehensively investigate their effects on cycle characteristics. The performance characteristics for various modified and regeneration cycles are presented at the same values of the operating parameters. The present modified cycles with steam injected cycles achieve an additional power output and higher efficiencies, resulting in a lower specific cost. At the chosen values of the operating parameters, the enhancement achieved in the overall efficiency for the simple, reheat (with steam injection at high and low pressures) and partial oxidation (with steam injection at high and low pressures) gas turbine cycles are of about 20~30%, 120~200%, 10~12%, 120~260%, 20% respectively. The present modified cycles technique can be considered among the possible ways to improve the performance of gas turbine cycles based power plants at feasible costs. This concept can be used for similar core engines

Keywords:

Comparative Study of Steam Injection Effects on Operation of Gas Turbine Cycles

Published In:

Effect of Rotation and Surface Roughness on Heat Transfer Rate to Flow Through Vertical Cylinders in Steam Condensation processes

Hany. A. M. Beblawy

Abstract:

The enhancement in the rate of the heat transfer resulting from rotating smooth and rough vertical cylinders, of 1.28 and 21.75 μm average roughness, respectively, are experimentally studied. Experiments were carried out for cooling fluid Reynolds numbers from 3300 to 7800 with varying the rotational speed up to 280 rpm. Experimental runs at the stationary case showed an acceptable agreement with the theoretical values. The experimental Nusselt number values at various rotational speeds are correlated as functions of Reynolds, Weber, and Prandtl numbers for smooth and rough surfaces. The correlated equations were compared with the correlation obtained by another author. The results show that the enhancement of the heat transfer rate becomes more appreciable for low Reynolds numbers at high rotational speeds and for high Reynolds numbers at low rotational speeds. The rotation causes an enhancement in the overall heat transfer coefficient of 189% at Re=7800, We=1084, and Pr=1.48 for smooth surface and of 13.7% at Re=4700, We=4891, and Pr=1.696 for rough surface. Also, the enhancement in the heat transfer rates utilizing rotary surface becomes more pronounced for the smooth surface compared with the rough one, therefore the choice of the heat transfer surface is very important. The present work shows a reduction in the heat transfer rate below its peak value depending on the type of the heat transfer surface. It is shown that the enhancement in the heat transfer, i.e., enhancement in the Nusselt number, depends on the Weber number value and the surface type while the Nusselt number value mainly depends on the Reynolds and Prandtl numbers. Correlated equation have been developed to represent the Nusselt number values as functions of the Weber and Reynolds numbers within the stated ranges of the parameters.

Keywords:

Effect of Rotation and Surface Roughness on Heat Transfer Rate to Flow Through Vertical Cylinders in Steam Condensation processes

Published In:

Conceptional Design Modeling of Combined Power Generation Cycle for Optimum Performance

Hany. A. M. Beblawy

Abstract:

The present paper studies the general characteristics and evaluates the optimum performance of a simple two-stage compression partial oxidation gas turbine (POGT) cycle that has been combined with a Rankine cycle. The controlling parameters of the combined cycle that give optimum performance are determined and fitted into functional correlation equations. The values of the first-law efficiency and the second-law efficiency (\(\dot{e}_I\) and \(\dot{e}_II\), respectively) for the combined cycle are compared with those obtained for single POGT cycles. The effects of irreversibilities of the different units of the cycles are considered in the study. The combination of a POGT cycle with the Rankine cycle has achieved a maximum enhancement in net work output of \(28.76\%\) and optimum values of \(\dot{e}_I \approx 58\%\) and \(\dot{e}_II \approx 80\%\). The present findings can form a very important basis for a complete phenomenological design of a combined POGT/Rankine cycle to achieve optimum performance.

Keywords:

Conceptional Design Modeling of Combined Power Generation Cycle for Optimum Performance

Published In:

Energy & Fuels, American Chemical Society Journal, USA, Vol. 17, No. 6, PP. 1492-1500
Entropy Generation in Counter Flow Gas to Gas Heat Exchangers

Hany. A. M. Beblawy

Abstract:

Analysis of heat transfer and fluid flow thermodynamic irreversibilities is realized on an example of a counter flow double pipe heat exchanger utilizing turbulent air flow as a working fluid. During the process of mathematical model creation and for different working and constructing limitations, total thermodynamic irreversibility is studied. The present work proves that the irreversibility is occurred due to unequal capacity flow rates (flow imbalance irreversibility). It is concluded that the heat exchanger should be operated at effectiveness greater than 0.5 and the best design will be achieved when approach from one where low irreversibility is expected. A new equation is adopted to express the entropy generation numbers for imbalanced heat exchangers of similar design with smallest deviation from the exact value. The results obtained from the new equation are compared with the exact values and with that obtained by another author.

Keywords:

Entropy Generation in Counter Flow Gas to Gas Heat Exchangers

Published In:

Comparative Study of Solar Air Humidification - Dehumidification Unit

Hany. A. M. Beblawy

Abstract:

The present work deals with one of the new techniques of saline water desalination. It is based on the humidification of ambient air and then dehumidification of this humid air to produce fresh water. Solar ponds as a source of hot saline water are well adapted for coupling with the unit. A computer programs were designed to investigate the performance characteristics at different operating conditions. The important design descriptions and the operating parameters of such units are identified. The effects of the operating parameters on the unit performance characteristics are studied. The productivities obtained from simple and modified models are qualitatively compared with the experimental values. Due to the simplicity of this technique, it may be a good candidate and is recommended if one looks for a solution for fresh water needs of small communities living in rural areas.

Keywords:

Comparative Study of Solar Air Humidification - Dehumidification Unit

Published In:

Proceedings of 15th CHISA'2002 International Conference, Prague , ,
Conceptional Design Modeling of Gas Turbine Cycle for Optimum Performance

Hany. A. M. Beblawy

Abstract:

The present paper discusses gas turbine operating ranges of values of controlling cycle parameters for maximum first law efficiency $\eta_1$, second law efficiency $\eta_{II}$, and work output $w_{net}$. Three cycles have been studied: simple cycle, recuperative cycle and general open cycle. Correlation equations relating maximum values of $\eta_1$, $\eta_{II}$ and $w_{net}$ to controlling parameters (compressor and turbine efficiencies, maximum cycle temperature, isentropic temperature ratio, fuel/air ratio, heat exchanger effectiveness and pressure drops in combustion chamber and heat exchanger) have been determined and discussed. The present paper reveals that cycle performance parameters $\eta_1$, $\eta_{II}$ and $w_{net}$ drastically depend on cycle controlling parameters. There is no narrow region of values of controlling parameters that produce concurrent maximum values of $\eta_1$, $\eta_{II}$ and $w_{net}$. The maximum cycle temperature for the three cycles considered has a linear effect on $\eta_1$, while other controlling parameters have nonlinear effects on $\eta_1$, $\eta_{II}$ and $w_{net}$. For the general open cycle, the pressure drops $\Delta P_{cc}$ and $\Delta P_{ex}$ have equal decreasing effects on $\eta_1$, $\eta_{II}$ and $w_{net}$, while, both the fuel/air ratio $f$ and heat exchanger effectiveness $\eta_X$ have equal increasing effect on these performance parameters. The present correlation equations, augmented with other experimental and detailed design studies for each of the cycle units could provide good basis for the realistic design process of actual turbines.

Keywords:

Conceptional Design Modeling of Gas Turbine Cycle for Optimum Performance

Published In:

Proceeding of 15th CHISA‘2002 International Conference, Prague , ,
Investigate of Centrifugal Compressor Stabilization Techniques

Fayez M. Wassef, Hany A. Mohamed, Ahmed S. Hassan, and M. A. Zaki

Abstract:

Compressors have a limited stable operating range, due to occurrence of rotating stall and surge, so many techniques were introduced to increase its stability and more enhancements still are needed for optimum performance. Two different techniques for enhancing the compressor stability are investigated in the present work. The first technique makes use of splitters with different lengths located at various positions through the diffuser passages. In the second, radial grooves with different geometric parameters are manufactured through the compressor front casing matching with the diffuser passages and the vaneless regions. Influences of various geometric parameters on the stability of the compressor using the two techniques are studied. Enhancement in the flow and pressure coefficients at stall initiation of about 22.5 % and 4.4 % respectively, could be achieved by providing the compressor with diffuser splitters. Providing the compressor with radial grooves achieves an enhancement in the flow coefficient at stall initiation reaches to 45.5 %. The flow coefficient at stall initiation resulted from the use of the radial grooves technique is given in a form of streamlines in terms of the grooves width and depth. The grooves width and depth required for optimum flow stability could be predicted from these streamlines for similar compressors. The present experimental results show an acceptable agreement with those obtained by another author using similar compressor.

Keywords:

Investigate of Centrifugal Compressor Stabilization Techniques

Published In:

Journal of Engineering Sciences, JES, Assiut University, Vol. 33, No. 5,
Validations and Investigations of a Kaplan Turbine Performance characteristics

Hany A. Mohamed ; Ahmed S. Hassan and Omar M. E. Abdel-Hafez

Abstract:

A theoretical model is developed for the effect of the operating parameters and the geometric parameters on the Kaplan turbine performance under design and off-design conditions. In the theoretical model, the incidence loss at the runner inlet that exists under off-design conditions for both positive and negative incidence angles is taken into account. The runner internal loss and the draft tube loss, which exist even under design conditions, are also taken into consideration through the use of simple and reasonable empirical expressions. The experimental works were carried out to validate the theoretical results. An optimization technique is adopted to obtain the operating parameters that achieve the best possible efficiency of a Kaplan turbine. A chart is deduced for detecting the suitable values of the operating parameters that achieve efficiency higher than 88% for different geometric parameters of the axial flow turbine, constant runner inlet blade angle. Comparisons of the obtained results with the present experimental and available published works show an acceptable agreement

Keywords:

Validations and Investigations of a Kaplan Turbine Performance characteristics

Published In:

Journal of Engineering Sciences, JES, Assiut University , Vol. 33, No. 4 , pp. 1341-1357
Comparative Study of Steam Injection Effects on Operation of Gas Turbine Cycles

Hany. A. M. Beblawy

Abstract:

Gas turbine cycle technologies will play a major role in future power generation and several well-justified concepts have been developed or are the subject of major feasibility studies. In the present work, gas turbine cycles are modified with steam injection between the combustion chamber exit and the gas turbine inlet. Heat recovery steam generators, utilizing the exhaust gases, provide these cycles with the injected steam at saturated vapor. The thermodynamic characteristics of the various cycles are considered in order to establish their relative importance to future power generation markets. The irreversibility of the different composing units of the cycles and the variation of gas properties due to steam injection as well as changes in the interrelation of component performance parameters are taken into account. The isentropic temperature ratio and maximum to minimum cycle temperature ratio are varied over some ranges that slightly exceed their practically acceptable bounds in order to comprehensively investigate their effects on cycle characteristics. The performance characteristics for various modified and regeneration cycles are presented at the same values of the operating parameters. The present modified cycles with steam injected cycles achieve an additional power output and higher efficiencies, resulting in a lower specific cost. At the chosen values of the operating parameters, the enhancement achieved in the overall efficiency for the simple, reheat (with steam injection at high and low pressures) and partial oxidation (with steam injection at high and low pressures) gas turbine cycles are of about 20–30%, 120–200%, 10–12%, 120–260%, 20% respectively. The present modified cycles technique can be considered among the possible ways to improve the performance of gas turbine cycles based power plants at feasible costs. This concept can be used for similar core engines.

Keywords:

Comparative Study of Steam Injection Effects on Operation of Gas Turbine Cycles

Published In:

Stability and Performance of a Low Speed Compressor with Modified Casing

Fayez M. Wassef, Ahmed S. Hassan, Hany A. Mohamed, and Mohamed A. Zaki

Abstract:

The aim of the present work is to increase the limit of stability and improve the performance of an actual aircraft turbocharger compressor with different casing modifications. Three schemes of modifications in the shroud side of the compressor casing through the vaneless region; circumferential groove, protrude and combined of groove and protrude, were studied. The time variations of wall static pressure were observed using couple of pressure transducers with high frequency response in the vaneless region at different compressor operating conditions. Stall initiation and surge triggering were detected by analyzing both of the fluctuations of pressure signals and the power spectrum density (PSD) which deduced by using the Fast Fourier Transformation analysis (FFT). The number and speed of stall cells relative to the impeller speed were investigated. The flow angles, that are representing the stall initiation for the original compressor, were studied theoretically and experimentally. Both the theoretical and the experimental results were compared with those experimentally obtained by another author and show good agreements. The present measurements show that the inception of unsteady flow which leads to rotating stall initiation hence surge trigger appears at the vaneless region between the impeller exit and the diffuser vane leading edge. The modified casing by one way of the three-presented schemes can be used to increase the limit of stability for low speed compressor at different operating conditions. The compressor with groove height $H_g = 0.2$ and depth $T_g = 0.2$ gives about 55% and 39% improvement in stall margin, but unfortunately with decrease in the pressure coefficient at low flow rates. While the compressor achieves improvement between 14% and 26% in the range of stable operating based on surge margin and about 13% in pressure coefficient. Modification utilizing combination of groove and protrude achieves improvements of about 28% in stall margin, 22% in surge margin and 4% in maximum pressure coefficients.

Keywords:

Stability and Performance of a Low Speed Compressor with Modified Casing

Published In:

Journal of Engineering Sciences, JES, Assiut University, Vol. 32, No. 5, pp. 2025-2047
Entropy Generation in Counter Flow Gas to Gas Heat Exchangers

Hany. A. M. Beblawy

Abstract:

Analysis of heat transfer and fluid flow thermodynamic irreversibilities is realized on an example of a counter flow double pipe heat exchanger utilizing turbulent air flow as a working fluid. During the process of mathematical model creation and for different working and constructing limitations, total thermodynamic irreversibility is studied. The present work proves that the irreversibility is occurred due to unequal capacity flow rates (flow imbalance irreversibility). It is concluded that the heat exchanger should be operated at effectiveness, $\varepsilon$, greater than 0.5 and the best design will be achieved when $\varepsilon$ approach from one where low irreversibility is expected. A new equation is adopted to express the entropy generation numbers for imbalanced heat exchangers of similar design with smallest deviation from the exact value. The results obtained from the new equation are compared with the exact values and with that obtained by another author.

Keywords:

Entropy Generation in Counter Flow Gas to Gas Heat Exchangers

Published In:

Journal of Engineering Sciences, JES, Assiut University, Vol. 31, No. 4, pp. 895-909
Prediction and Optimization of a Radial Flow Hydraulic Turbine Performance

Omar M. E. Abdel-Hafez, Ahmed S. Hassan, and Hany A. Mohamed

Abstract:

A proposed model is introduced for predicting the performance characteristics of an inward flow hydraulic turbine at design and off-design conditions. The model simulates the flow through the turbine runner based on fundamental principles. The incidence loss at the runner inlet, which commonly exists under off-design conditions is taken into account for both positive and negative incidence angles. The runner internal loss and the draft tube loss, which exist even under design conditions are taken into consideration through the use of simple and reasonable empirical expressions. The model is developed for studying the effect of the operating and the geometric parameters on the turbine performance under design and off-design conditions. The energy losses at the runner entrance due to incidence and that occur at the runner exit are minimized. An alternative optimization method is adopted to obtain the best possible efficiency of the turbine. Moreover, new charts are obtained and can be used for maximizing the efficiency of the radial turbine at different operating conditions. The obtained results from the proposed model show an acceptable agreement with the available published experimental and theoretical data.

Keywords:

Prediction and Optimization of a Radial Flow Hydraulic Turbine Performance

Published In:

Journal of Engineering Sciences, JES, Assiut University , Vol. 31, No. 2 , pp. 321-343
ANALYSIS AND OPTIMIZATION OF BIODIESEL PRODUCTION FROM DESERT PLANTS

Prof. Hany A. Mohamed, Prof. Omar M. El Anwar, Dr. Abd El Moneim M. Nassib -and Students group Ahmed O. Mohammed, Amr A. El saaed, Hosam M. Farhgl, Safaa S. Mohammed, Salma K. Abd El Moneim, Mohammed A. Helmy, Manar A. Mahmoud, and Walaa M. Bauomi

Abstract:

The new process technologies developed during the last years made it possible to produce biodiesel from desert plants. From an economic point of view; the production of biodiesel is very feedstock sensitive. Many previous reports estimated the cost of biodiesel production based on assumptions, made by their authors, regarding production volume, feedstock and chemical technology. From a waste management standpoint, producing biodiesel from used frying oil is environmentally beneficial, since it provides a cleaner way for disposing these products; meanwhile, it can yield valuable cuts in CO2 as well as significant tail-pipe pollution gains. This paper introduces a review of some researches related to the production of biofuels from plants. The present study is focused on five types of plants which are castor, coconut, dates nucleus, jatropha and olive. Plants comparison in terms of growing conditions and how to convert each plant's oil to biofuels are presented. Chemical properties (heating value, flash point, viscosity/etc) of pure oil, oil mixing ratios with the petro diesel and for pure biofuels and also economic aspects are reviewed. The study leads to the best plants (castor and jatropha) for the production of biofuels in Egypt. The plants are appropriate to the circumstances of their agriculture with farming conditions in Egypt and non-edible. Biodiesel output from these plants has chemical properties approach to the chemical properties of petro diesel

Keywords:

Biofuels-Biodiesel-Castor oil- Jatropha oil-Chemical properties- Desert plants- ASTM

Published In:

Seventh Annual Conference of the future new and Renewable energy in the Arab world , ,
Performance characteristics of modified gas turbine cycles with steam injection after combustion exit

Mahmoud Salem Ahmed1, and Hany Ahmed Mohamed

Abstract:

Gas turbine cycle technologies will play a major role in future power generation, and several well-justified concepts have been developed or are the subject of major feasibility studies. In the present work, gas turbine cycles are modified with steam injection between the combustion chamber exit and the gas turbine inlet. Heat recovery steam generators, utilizing the exhaust gases, provide these cycles with the injected steam at saturated vapor. The thermodynamic characteristics of the various cycles are considered in order to establish their relative importance to future power generation markets. The irreversibility of the different composing units of the cycles and the variation of gas properties due to steam injection as well as changes in the interrelation of component performance parameters are taken into account. The isentropic temperature ratio and maximum to minimum cycle temperature ratio are varied over some ranges that slightly exceed their practically acceptable bounds in order to comprehensively investigate their effects on cycle characteristics. The performance characteristics for various modified and regeneration cycles are presented at the same values of the operating parameters. The present modified cycles with steam injected cycles achieve an additional power output and higher efficiencies, resulting in a lower specific cost. At the chosen values of the operating parameters, the enhancement achieved in the overall efficiency for the simple, reheat (with steam injection at high and low pressures) and partial oxidation (with steam injection at high and low pressures) gas turbine cycles are of about 20–30%, 120–200%, 10–12%, 120–260% and 20%, respectively. The present modified cycles technique can be considered among the possible ways to improve the performance of gas turbine cycles-based power plants at feasible costs. This concept can be used for similar core engines. Copyright © 2011 John Wiley & Sons, Ltd.

Keywords:

gas turbines; partial oxidation cycle; reheat cycle

Published In:

INTERNATIONAL JOURNAL OF ENERGY RESEARCH
Performance characteristics of single cylinder diesel engine under different operating conditions

Hany Ahmed Mohamed

Abstract:

Recently, it is predicted that the fossil fuels will be sufficient for a few decades at the present extraction rates. So, the performance studies of the internal combustion engines play an important role to achieve the best operating point at different weather temperatures. In the present study, the effects of the inlet air temperatures on the engine performance characteristics were studied at different cooling loads. Several experiments were carried out on a single cylinder diesel engine (SCDI). The performance characteristics of SCDI included: brake power, specific fuel consumption, brake thermal efficiency and exhaust emissions (carbon dioxide, CO2, carbon monoxide CO, and hydrocarbon HC). The findings show that the inlet air temperature and cooling conditions have appreciable effect on the performance characteristics of the SCDI especially at low cooling rate. It can be concluded that the high cooling rate leads to the enhancement in the brake thermal efficiency, the b.s.f.c, and the emitted CO2, CO, and HC. On the other hand the high cooling rate leads to the decrease in the volumetric efficiency. So, a compromising between the inlet air temperature and the cooling rate should be recommended for the engine best performance.

Published In:

Study of The Performance of a Swash Plate Compressor Incorporated with an Automotive Air Conditioning System

M. M. S. Ahmed, O. M.A. Hafez, H. A. Mohamed, and A. S. Hassan

Abstract:

In this paper a mathematical model for swash plate compressor is presented. Using this model, the description of the swash plate motion and the average power input to the compressor was derived as a function of the compressor geometry and angular speed under different operating conditions. The performance of an automotive air conditioning system provided with a swash compressor type is experimentally studied. The theoretical and experimental studies of the swash plate compressor indicate that the average power acting on the swash compressor mainly depends upon the swash plate inclination angle, rotational speed and system pressure. It is concluded that, small value of the swash plate inclined angle is necessary for decreasing the power lost due to friction between the slipper and the swash plate and decreasing the shaft power required for the swash compressor. Also, in the design case when a long stroke and minimum shaft power for the swash plate compressor are required, the present analysis is very important for selecting the suitable inclined angle and the stroke length of the swash compressor. The experimental results show that low rotational speed, high cooling capacity and low shaft power per unit refrigerant mass flow rates are required for high values of coefficient of performance and volumetric efficiency. The coefficient of performance relative to that obtained for the corresponding Carnot cycle is parabolically decreased by increasing the shaft power per unit refrigerant mass flow rates. The shaft power values obtained from the theoretical results agree with those obtained from a simulated program prepared by the manufacture company of the swash compressor [8] under different operating conditions.

Keywords:

Study of The Performance of a Swash Plate Compressor Incorporated with an Automotive Air Conditioning System

Published In:

Journal of Engineering Sciences, JES, Assiut University, Vol. 32, No. 1, pp. 181-197
Experimental Study of Natural Convection Heat Transfer through Horizontal Open Ended Equilateral Triangular Channels

Hany A. Mohamed a, Mohamed A. Omara b, Mahmoud S. Ahmed c and Mohamed F. Abdeen

Abstract:

Experimental study of natural convection heat transfer inside smooth and rough surfaces of horizontal equilateral triangular channels with a uniformly heated surface are performed. The effect of smooth and rough surface of average roughness, ra = 0.02μm, on the heat transfer characteristics are studied. The local and average heat transfer coefficients and Nusselt number are obtained for smooth and rough channel at different Rayleigh numbers from 6.45 × 10^5 to 4.45 × 10^6. The findings show that the values of temperature difference between the inside surface and ambient air increase with increase of axial distance from both ends of the channel until a maximum value at the middle of the channel. The results show a higher values of local (Nux) for rough channel along the axial distance compared with the smooth channel. The average Num of rough channel is higher than Num of smooth channel by about 7%. The results obtained are correlated using dimensionless groups for both rough and smooth surfaces of the equilateral horizontal triangular channels

Keywords:

Convection, Constant heat flux, Horizontal Triangular Channels, Rough surface, Smooth surface

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Journal of Engineering Sciences, JES , Vol. 40, No. 4 ,
NATURAL CONVECTION HEAT TRANSFER INSIDE VERTICAL AND INCLINED OPEN ENDED EQUILATERAL TRIANGULAR CHANNELS

Mahmoud S. Ahmed, Hany A. Mohamed, Mohamed A. Omara, and Mohamed F. Abdeen

Abstract:

Experimental study of natural convection heat transfer inside smooth and rough surfaces of vertical and inclined equilateral triangular channels of different inclination angles with a uniformly heated surface are performed. The inclination angle is changed from 15° to 90°. Smooth and rough surface of average roughness (0.02mm) are used and their effect on the heat transfer characteristics are studied. The local and average heat transfer coefficients and Nusselt number are obtained for smooth and rough channels at different heat flux values, different inclination angles and different Rayleigh numbers (Ra) 6.48 × 105 ≤ Ra ≤ 4.78 × 106. The results show that the local Nusselt number decreases with increase of axial distance from the lower end of the triangular channel to a point near the upper end of channel, and then, it slightly increases. Higher values of local Nusselt number for rough channel along the axial distance compared with the smooth channel. The average Nusselt number of rough channel is higher than that of smooth channel by about 8.1% for inclined case at θ = 45o and 10% for vertical case. The results obtained are correlated using dimensionless groups for both rough and smooth surfaces of the inclined and vertical triangular channels.

Keywords:

Natural Convection, Constant heat flux, Triangular Channels, Rough surface, Smooth Surface

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Journal of Engineering Sciences, Assiut University, Faculty of Engineering, 41-6, 2160 - 2174
Repulsion-Based Model for Contact Angle Saturation in Electrowetting

Hassan A. Abdellah Ali Hany A. Mohamed M. Abdelgawad

Abstract:

We introduce a new model for contact angle saturation phenomenon in electrowetting on dielectric systems. This new model attributes contact angle saturation to repulsion between trapped charges on the cap and base surfaces of the droplet in the vicinity of the three-phase contact line, which prevents these surfaces from converging during contact angle reduction. This repulsion-based saturation is similar to repulsion between charges accumulated on the surfaces of conducting droplets which causes the well known Coulombic fission and Taylor cone formation phenomena. In our model, both the droplet and dielectric coating were treated as lossy dielectric media (i.e., having finite electrical conductivities and permittivities) contrary to the more common assumption of a perfectly conducting droplet and perfectly insulating dielectric. We used theoretical analysis and numerical simulations to find actual charge distribution on droplet surface, calculate repulsion energy, and minimize energy of the total system as a function of droplet contact angle. Resulting saturation curves were in good agreement with previously reported experimental results. We used this proposed model to predict effect of changing liquid properties, such as electrical conductivity, and system parameters, such as thickness of the dielectric layer, on the saturation angle, which also matched experimental results.

Keywords:

Electrowetting Contact Angle Saturation Coulombic fission Electrical repulsion

Published In:

Biomicrofluidics, Vol. 9, 014115
PERFORMANCE STUDY OF A MODIFIED RANQUE-HILSCH VORTEX TUBE

Mohamed S. El-Soghiar, Mohamed F.F. El-Dosoky, Ali K. Abdel-Rahman, Hany A. Mohamed, Mahmoud G. Morsy

Abstract:

In the present work, a Ranque-Hilsch vortex tube (RHVT) is modified by suggesting a novel vortex chamber at inlet. The performance of the modified vortex tube is studied experimentally. Suggested lengths for the vortex chamber are 10, 15, and 20 mm and the vortex chamber diameters are 12, 16, and 20 mm. All vortex chambers with different lengths and diameters are tested experimentally at variable inlet conditions. It’s found that the vortex chamber diameter has a dominant effect on the performance compared with the vortex chamber length. The results are compared with that obtained by a conventional vortex tube. The results show that the vortex chamber gives an enhancement in the isentropic efficiency reach to 15.9%. The results for a vortex chamber of 15 mm length and 20 mm diameter has the best performance.

Keywords:

Keywords: vortex tube, vortex chamber.

Published In:

Journal of Engineering Sciences, vol. 42-no. 6, pp. 1414-1429
Study a Model Close to the Actual Cycle Of Internal Combustion Engines

M. Hamdy, A. O. M. E. Abdel-Hafez Hany A. Mohamed A. M. Nassib

Abstract:

Using simulating models for internal combustion engine cycles is appreciable method for predicting the engines performance for saving the time and the effort. Fuel air ratio and gas variable specific heats are taken into account in the present work. Irreversibilities resulted from nonisentropic compression and expansion processes and heat loss through the cylinder wall are also taken into account in the present model. Finite difference method is applied for estimating the states through the heat addition process and compression and expansion strokes. Computer program is designed for the model includes all the above conditions and the cycle parameters. Experimental test was carried out on a single cylinder constant speed diesel engine to verify the obtained results using the present model. The obtained results show a good agreement with the corresponding data recorded from the experimental tests. Other Comparisons are done with the corresponding results of an actual engine model results which published for gasoline and diesel engines. The obtained results from the model show a good agreement with the corresponding data in researches. The effect of the cycle parameters (inlet air temperature, inlet air pressure, air fuel ratio, compression ratio, and compression and expansion efficiencies) on the power output and thermal efficiency are studied. It is shown that the power and thermal efficiency increase with the increase of compression and expansion efficiencies, inlet air pressure and compression ratio. For gasoline engine cycle the optimum value of compression ratio is around 10 to be prevented from detonation, and for diesel the optimum value is around 20. With increasing air fuel ratio the power output increase then decrease and the thermal efficiency increases, so the optimum value of air fuel ratio for gasoline engine cycle is around 13 and for diesel around 15. With increasing the inlet air temperature the power output and thermal efficiency are decreased. The Specific Fuel Consumption decreases with increasing power for the two cycles. The benefit from the research is that optimum parameters for operating are predicted by the model. The obtained results would be more realistic and implemented on the performance evaluation of the internal combustion engine

Keywords:

Otto, Diesel, Dual, Irreversible, Combustion, Performance, heat transfer

Published In:

Experimental Investigation of an Adaptive Neuro-Fuzzy Control Scheme For Industrial Robots.

Farrage, A. B. Sharkawy, Ahmed S. Ali, E. S. Soliman, and H. A. Mohamed

Abstract:

NULL

Keywords:

NULL

Published In: