Current injection-based DC-link capacitance estimation using support vector regression

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Abstract:

A novel online capacitance estimation method for a DC-link capacitor in a three-phase back-to-back pulse width modulation (PWM) converter is proposed. A controlled AC current with a frequency lower than the line frequency is injected into the input side, which then causes AC voltage ripples at the DC output side. With this AC voltage component extracted by band-pass filters, the capacitance is estimated by the support vector regression method without measuring the DC-link current. A function that defines the relation between a given capacitor power and its corresponding capacitance is determined using a set of training data. This function is then used to predict the output for the given input which is not included in the training set. The proposed method can simply be implemented with only software and no additional hardware. Experimental results confirm that the estimation error is less than 0.146%.

Keywords:

PWM power convertors; band-pass filters; capacitance measurement; capacitors; electric current control; regression analysis; support vector machines; AC voltage component; AC voltage ripple; DC output side; DC-link capacitor power; DC-link current; PWM converter; band pass filter; controlled AC current; current injection-based DC-link capacitance estimation; estimation error; online capacitance estimation method; support vector regression method; three phase back-to-back pulse width modulation converter; training data set

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