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Real-time Coupled Ensemble Kalman Filter Forecasting & Nonlinear Model Predictive Control Approach for Optimal Power Take-off of a Wave Energy Converter DANIELE CAVAGLIERI, THOMAS BEWLEY, UC San Diego, MIRKO PREVISIC, Re Vision Consulting LLC — In recent years, there has been a growing interest in renewable energy. Among all the available possibilities, wave energy conversion, due to the huge availability of energy that the ocean could provide, represents nowadays one of the most promising solutions. However, the efficiency of a wave energy converter for ocean wave energy harvesting is still far from making it competitive with more mature fields of renewable energy, such as solar and wind energy. One of the main problems is related to the difficulty to increase the power take-off through the implementation of an active controller without a precise knowledge of the oncoming wavefield. This work represents the first attempt at defining a realistic control framework for optimal power take-off of a wave energy converter where the ocean wavefield is predicted through a nonlinear Ensemble Kalman filter which assimilates data from a wave measurement device, such as a Doppler radar or a measurement buoy. Knowledge of the future wave profile is then leveraged in a nonlinear direct multiple shooting model predictive control framework allowing the online optimization of the energy absorption under motion and machinery constraints of the device.

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