clamping brakes, hydraulic control valves or other. For modeling and simulation purposes, two alternative methods have been common. The first method is to have two models for the system: one for the latched state ($v=0$) and one for the moving state ($v=f(F_e(t), R_m, t)$), and to switch between these at the right instants. The other is to introduce an additional large resistance R_l in the mathematical model, which is active during latching intervals and zero otherwise. Thus here no assumption is made about how the latching mechanism is realized, although the latter method may be seen as a simple model of a clamping brake. The two methods give practically no difference in the result as long as the resistance is chosen large enough. We use the second approach with $R_l \geq 1 \times 10^9$ kg/s. Because the power take-off is only resistive, the latching control machinery has no reactive power flow.

3.6 Phase Control by Clutching (PMC and TUC). The only difference between clutching and latching is that the resistance is switched between zero and a constant instead of between a (different) constant and a very large value (in principle infinite). This only (once the device geometry has been set). A good approximation to the optimal parameter settings is then achieved by using knowledge about the average wave period. All that is needed is then an online estimate of the instantaneous average period, and the parameters may be set according to a predefined schedule. If the relation between wave frequency and parameter settings is not known, the schedule may be established based on experience or trial and error. For the threshold unlatching and unclutching strategies, information about the wave heights are also needed [20].

In our implementation, we have processed the last 100 zero up-crossing periods in computing the needed statistical measures.

3.7.2 Extremum Seeking. Extremum seeking control is a powerful method for real-time optimization where a modulation of the control input is used to drive the control parameters to their optimum value. The method does not depend on having a model of the process; all that is needed is that the control goal can be formulated as an objective function that is convex in the control parameters. It may be freely defined by the control designer. The

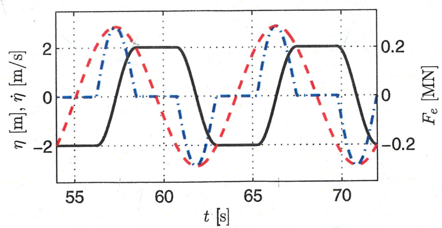

Fig. 15 Regular wave (T=9 s and H=1 m) time series example for the PML and TUL strategies. Line patterns as in Fig. 6.

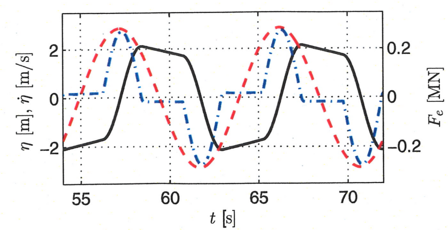

Fig. 17 Regular wave (T=9 s and H=1 m) time series example for the PMC and TUC strategies. Line patterns as in Fig. 6.

Downloaded 05 Dec 2011 to 134.89.11.41. Redistribution subject to ASME license or copyright; see http://www.asme.org/terms/Terms_Use.cfm