

Negative Imaginary Systems Theory and Applications

Prof. Ian R. Petersen

School of Engineering and Information Technology

UNSW Canberra at the Australian Defence Force Academy

www: <http://routh.ee.adfa.edu.au/~irp/P1.html>

email: i.petersen@adfa.edu.au (or) i.r.petersen@gmail.com

Abstract: This presentation will cover recent developments in the theory of negative imaginary systems. The theory of negative imaginary systems arose out of a desire to provide a unified framework for the control of lightly damped structures with collocated force actuators and position sensors. The key result is a stability result which can be used design controllers guaranteed to yield robust closed loop stability in the face of unmodelled spillover dynamics. Some physical interpretations of this stability result will be given. These interpretations involve spring mass damper systems coupled together by springs. Related results to be presented connect the theory of negative imaginary systems to positive real systems theory and a negative imaginary lemma has been established which is analogous to the positive real lemma. The presentation will also consider controller synthesis and system identification results based on the theory of negative imaginary systems along with applications to the control of atomic force microscopes.



Bio sketch of speaker: Ian R. Petersen received Ph.D. in Electrical Engineering in 1984 from the University of Rochester. From 1983 to 1985 he was a Postdoctoral Fellow at the Australian National University. In 1985 he joined UNSW Canberra where he is currently Scientia Professor and an Australian Research Council Laureate Fellow in the School of Engineering and Information Technology. He is an Editor for *Automatica* and an Associate Editor for the *IEEE Transactions on Control Systems Technology*. He is a fellow of IFAC, the IEEE, and the Australian Academy of Science. His main research interests are in robust control theory, quantum control theory and stochastic control theory.