Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Modal analysis of non-homogeneous thermal fields in a turbulent pipe flow using extended proper orthogonal decomposition MANUEL GARCIA-VILLALBA, ANTONIO ANTORANZ, ANDREA IANIRO, OSCAR FLORES, Universidad Carlos III de Madrid — We analyze a DNS database of fully developed flow and heat transfer in a pipe with non-homogeneous thermal forcing using a modal decomposition. The modal decomposition employed is based on an extended proper orthogonal decomposition, in which the temperature is decomposed using standard proper orthogonal decomposition while the velocity is decomposed using an extended proper orthogonal decomposition using the temperature basis. This method allows to discern which velocity fluctuations are correlated to the temperature fluctuations, obtaining insight on the physical mechanisms of convective heat transfer. Reconstructing the velocity fields using the extended modes it is possible to show that with only 40% of the total turbulent kinetic energy we are able to reconstruct roughly 100% of the turbulent heat flux, for the particular case under study.

Manuel Garcia-Villalba
Universidad Carlos III de Madrid

Date submitted: 27 Jul 2017 Electronic form version 1.4