Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Large Eddy Simulation (LES) of turbulent flows within rotating cavities using a spectral vanishing viscosity (SVV) model ERIC SERRE, ERIC SEVERAC, MSNM-GP, UMR6181 CNRS/Aix-Marseille Universite, MSNM-GP TEAM — The highly accurate computation of turbulent rotating flows within cavity is of interest for both engineering applications (turbomachinaries), and fundamental research (one of the simplest cases with 3D turbulent boundary layers). LES results based on a SVV model will be presented in a shrouded rotor-stator cavity (ΔR/H=5, (R_{in}+R_{out})/ΔR=3.37) for Reynolds numbers up to Re=10^6. The second-order SVV operator is implemented in a Chebyshev-collocation Fourier-Galerkin pseudo-spectral code for solving cylindrical Navier-Stokes equations. The SVV model is shown to lead to stable discretizations without sacrificing the formal accuracy, i.e., exponential convergence, in the proposed discretization. As far as the authors are aware, efficient LES of fully turbulent flow in an actual shrouded rotor-stator cavity has not been performed before. Turbulent quantities are shown to compare very favourably with results of Direct Numerical Simulation (DNS) and experimental measurements. The results show a highly complex structure of the flow, involving laminar, transitional, and turbulent flow regions.

Eric Serre
MSNM-GP UMR6181 CNRS

Date submitted: 26 Jul 2006 Electronic form version 1.4