CDXU Update for NIMROD

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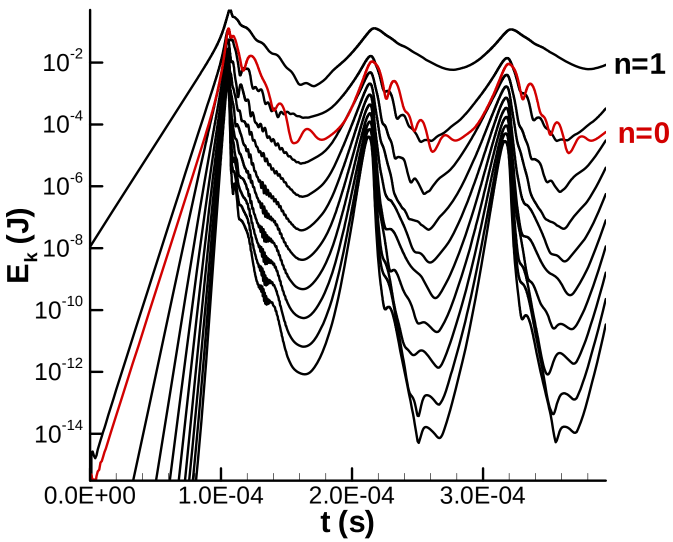
Parameters for the Three Nonlinear Computations

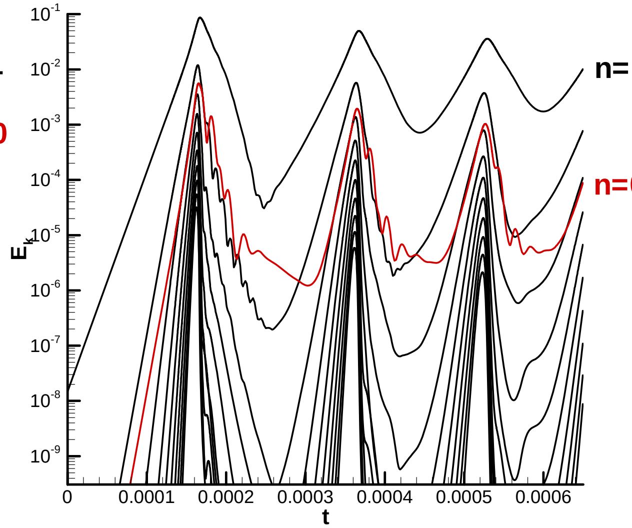
quantity	NIMROD (dimensional)			M3D (dimensionless)
$q(0)$	0.71	0.82	0.92	
Z_{eff}	2	2	2	2
$n_e(0)$	1.374×10^{19} m^{-3}	1.374×10^{19} m^{-3}	1.374×10^{19} m^{-3}	-
$\rho(0)$	1.149×10^{-8} kg/m^3	1.149×10^{-8} kg/m^3	1.149×10^{-8} kg/m^3	1
m_i	1.673×10^{-27} kg	1.673×10^{-27} kg	1.673×10^{-27} kg	-
τ_A	3.212×10^{-7} s	3.319×10^{-7} s	3.427×10^{-7} s	1
$\eta(0)/\mu_0$	9.34 m^2/s	9.005 m^2/s	8.72 m^2/s	5.15×10^{-5}
τ_r	6.239×10^{-3} s	6.445×10^{-3} s	6.655×10^{-3} s	1.94×10^{4}
$D_{particle}$	181.4 m^2/s	174.9 m^2/s	169.3 m^2/s	1×10^{-3}
$\nu_{kinematic}$	93.4 m^2/s	90.05 m^2/s	87.2 m^2/s	5.15×10^{-4}
χ_{perp}	164.8 m^2/s	158.9 m^2/s	153.9 m^2/s	9.09×10^{-4}
$\chi_{parallel}$*	1.0×10^{8} m^2/s	1.0×10^{8} m^2/s	6.467×10^{7} m^2/s	$c=6v_A$

*For computations using anisotropic heat transport, the M3D computations use the artificial sound propagation speed given in the table. The diffusivity used in the NIMROD computations is computed from the square of the same speed, multiplied by the electron collision time on axis. In addition, both codes use (γ-1) times the physical thermal diffusivity values; the table shows code input.

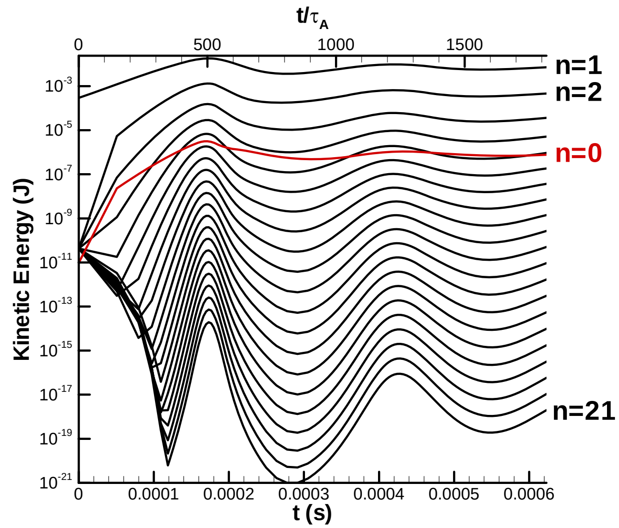
Nonlinear results for the different $q(0)$ profiles transition to a saturated state due to the large dissipation.



q(0)=0.71 Kinetic Energy Fluctuation History



q(0)=0.82 Kinetic Energy Fluctuation History



q(0)=0.92 Kinetic Energy Fluctuation History

	$q(0)$=0.71	$q(0)$=0.82	$q(0)$=0.92
Γ (μs)	100	160	270
Γ/τ_A	320	490	790

Discussion

- The linear mode at $q(0)=0.92$ appears to be marginal due to the large viscosity (Pm=10 and $S=2\times10^4$).
  - The growth rate increases by a factor of 5 as viscosity is reduced to zero.
  - More thorough verification of linear resistive 1/1 is still needed. [Recent PoP reports good agreement??]
- Artificial particle diffusion is large and has been used to kill the ballooning modes.
  - Recent PoP states that it is from thermal conduction.
- Nonlinear evolution in PoP is for $q(0)=0.92$ where NIMROD shows saturating 1/1.
- Even at $q(0)=0.82$, the NIMROD simulation is resolved with toroidal components $0\leq n\leq 10$.
- In retrospect it would have been better to wait for the invited talk/paper until after reaching agreement.
- I think that it would be worthwhile to write a comment for PoP.