Turbulence Optimization update

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Wistell Meeting, Jul 27, 2018

Update on turbulence optimization

- Last time: We showed that PTSM3D calculated different values for the coupling coefficient if the geometric parameters were slightly different
- Normally this does not occur, but STELLOPT optimization appears to drive the configuration towards these "pathological" configurations
- This time: Take the two geometric parameters and run them through non-linear GENE and calculate the heat-flux

Reminder: What the metric is

- We are trying to maximize the transfer of energy between the unstable and stable modes
- We are mostly interested in non-zonal transfer, since that is the dominant pathway for QHS
- The current metric (PTSM3D) adds all the transfer coefficients, τ_{ijk}, weighted by k_x and k_y to provide a global transfer quantity, evaluated at a given flux surface
- Calculation requires some geometric quantities evaluated on a field line for many ($\sim$100-200) poloidal turns

Three ways to calculate the parameters

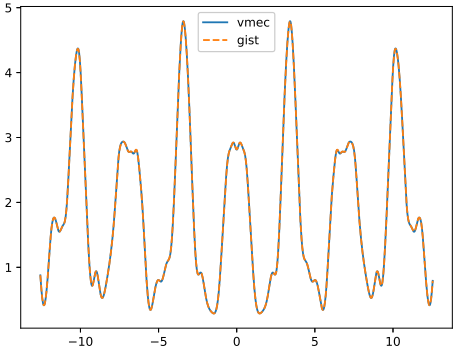
VMEC equilibrium	VMEC equilibrium	VMEC equilibrium
Geometric pars.	Geometric pars.	**EXIT STELLOPT**
PTSM3D	**EXIT STELLOPT**	Geometric pars.
EXIT STELLOPT	PTSM3D	PTSM3D

Methods 1 and 2 agree exactly at this stage. Method 3, where we calculate the Geometric parameters from the VMEC eq file using GIST differs slightly.

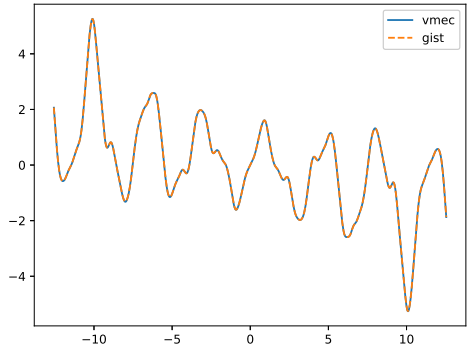
Run GENE on the two output files produced by the two methods

Comparisons of geometric coefficients between the two GENE inputs (4 poloidal turns, 256 points per turn)

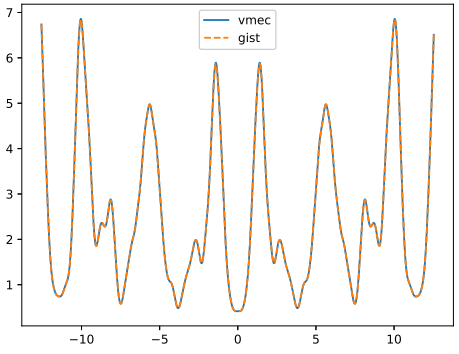
g_{11}



g_{12}



g_{22}



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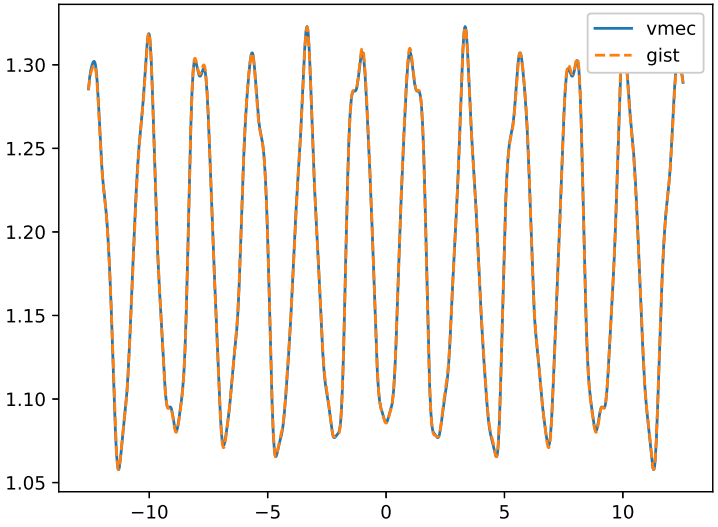
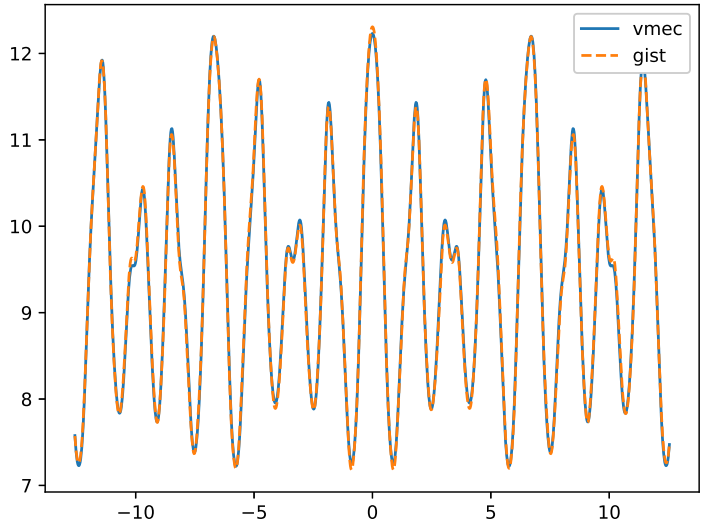
$\hat{B}$



$|J|$



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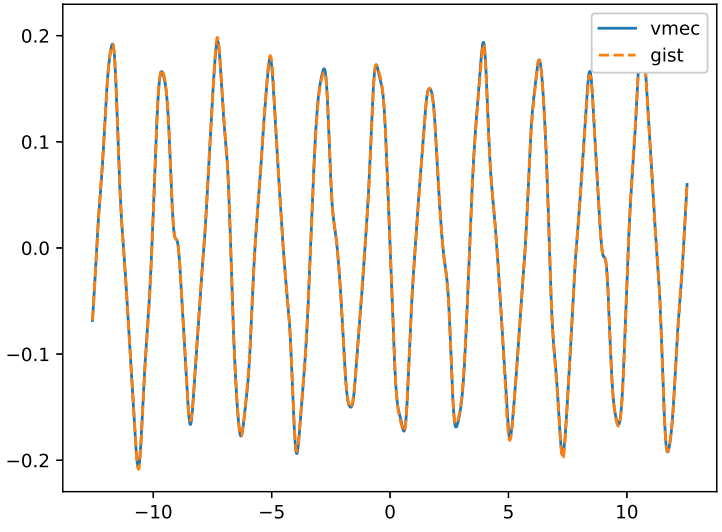
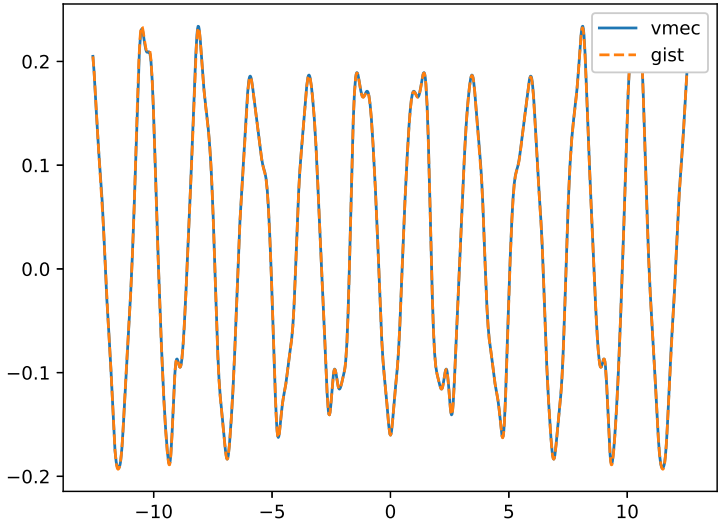
L_1



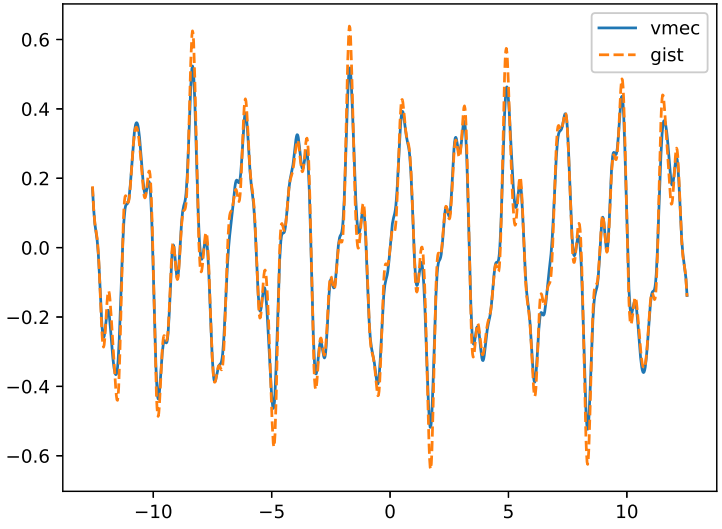
L_2



Run GENE on the two output files produced by the two methods

Comparisons of geometric coefficients between the two GENE inputs (4 poloidal turns, 256 points per turn)

dB/dt



- dB/dt shows the largest difference between the two
- This parameter is *not* used in the PTSM3D turbulence calculation

Move to Ian's slides