

NUMERICAL ANALYSIS AND SCIENTIFIC COMPUTING  
SEMINAR

*Accounting for Helicity in 3D NSE Computations*

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**Abstract:** It has recently become known that helicity, defined as the mean streamwise vorticity, is a fundamentally important quantity of the 3D Navier-Stokes equations. Helicity is a conserved quantity of inviscid flow, is cascaded jointly with energy through the inertial range, and is physically interpreted to be the degree to which a flow's vortex lines are tangled and intertwined. Until recently however, helicity has been ignored in NSE computations. In this talk I will show how helicity can be more accurately treated in finite element computations of the 3D NSE, which in turn leads to more accurate simulations. I will discuss two numerical schemes: one which enforces helicity preservation by the NSE nonlinearity (to mimic the continuous case) - joint work with Vince Ervin, and a second that solves for helicity directly inside of a velocity-vorticity method - joint work with Maxim Olshanskii. Numerical examples will be given that demonstrate the effectiveness of the methods.

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