Mathematics Colloquium

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- **Topic:** A new class of massively parallel direction splitting for the incompressible Navier-Stokes equations
- **Date & Time:** Thursday, Feb. 14 @ 3:30 PM
- **Place:** Room 207 Sid Richardson Building
- **Refreshments:** 3:00 PM in Room 318 Sid Richardson
- **Abstract:** I introduce in this talk a new direction splitting algorithm for solving the incompressible Navier-Stokes equations. The main originality of the method consists of using the operator

$$(I-\partial_{xx})(I-\partial_{yy})(I-\partial_{zz})$$

for approximating the pressure correction instead of the Poisson operator as done in all the contemporary projection methods. The complexity of the proposed algorithm is significantly lower than that of projection methods, and it is proved to have the same stability properties as the Poisson-based pressure-correction techniques, either in standard or rotational form. The first-order (in time) version of the method is proved to have the same convergence properties as the classical first-order projection techniques. Numerical tests reveal that the second-order version of the method has the same convergence rate as its second-order projection counterpart as well. The method is suitable for massively parallel computers and has been validated on three-dimensional cavity flows using grids composed of up to two billions points on a small cluster composed of 1024 processors only.