LOCAL-IN-TIME EXISTENCE AND REGULARITY OF THE n-DIMENSIONAL NAVIER-STOKES EQUATIONS VIA DISCRETIZATIONS

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Consider the equations:

$$u_t = \nu \Delta u - (u \cdot \nabla) u - \nabla p + f$$
$$\operatorname{div} u = 0$$

for $x \in [0,1]^n$ and $t \in (0,\infty)$, together with periodic boundary conditions and initial condition $u(x,0) = g(x)$ (with $\operatorname{div} g = 0$).

We present a proof of local-in-time existence of a smooth solution based on a discretization by a suitable Euler scheme. It will be shown that this solution exists in an interval $[0,T)$, where T depends on n, f and g. The proof given shows that the local-in-time regularity for this problem can be obtained by simple pointwise estimates of the solutions of the discretized problem.

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