DESCRIPTION

BHS

$$Navier - Stokes \quad Equation$$
$$u_t + \lambda_1(uu_x + vu_y) = -p_x + \lambda_2(u_{xx} + u_{yy})$$
$$v_t + \lambda_1(uv_x + vv_y) = -p_y + \lambda_2(v_{xx} + v_{yy})$$

where
$$u(t, x, y)$$
denotes the x-component of the velocity field,
$$v(t, x, y)$$
the y-component, and
$$p(t, x, y)$$
the pressure. Here,
$$\lambda = (\lambda_1, \lambda_2)$$
are the unknown parameters.
Solutions to the Navier-Stokes equations are searched in the set of divergence-free functions; i.e.,
$$u_x + v_y = 0.$$

This extra equation is the continuity equation for incompressible fluids that describes the conservation of mass of the fluid. We make the assumption that

$$u = \psi_y, \quad v = -\psi_x,$$

for some latent function
$$\psi(t, x, y)$$
.

References

[1] Maziar Raissi, Paris Perdikaris, and George Em Karniadakis. Physics Informed Deep Learning (Part II): Data-driven Discovery of Nonlinear Partial Differential Equations.