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## DK Seminar

January 14, 2015, 14:00 - 15:30  
University of Vienna,  
Faculty of Mathematics, OMP 1, HS 2

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### Local Bifurcation for a One-dimensional Reformulation of the Water Wave Problem

We are concerned with the free-boundary problem for an incompressible, inviscid fluid. Here, we are not only confronted with a system of nonlinear partial differential equations, the Euler equations of fluid dynamics, but rather nonlinear equations on an unknown domain. In the (periodic) travelling wave ansatz, assuming the propagation of a bulk of water with fixed shape over a flat bed, we can reformulate this problem as a linear PDE for the so called *stream function* on an unknown domain with nonlinear boundary conditions. Via a conformal hodograph transform, this system is now translated to a one-dimensional quasilinear pseudo-differential equation involving the periodic Dirichlet-Neumann operator and the periodic Hilbert transform for a strip.

In this setting, we will investigate a bifurcation result that assures locally the existence of non-trivial solutions, following a paper of A. Constantin, E. Varvaruca and W. Strauss relying upon the Crandall-Rabinowitz Theorem. However, we will drop the assumption of symmetry and prove directly from the reduced equations (Lyapunov-Schmidt reduction) the existence of non-trivial solutions.