Area: Hydraulic, Water Resources and Environmental Engineering

Level: PhD

Course title: Computational Hydraulics – 2-D Open-Channel Flows and Transport

Course advisor: M. Spasojevic

Course objective

Gain theoretical background and practical experience in development and application of mathematical models in the area of 2D open-channel flow and transport processes.

Course outline

Course topics

General introduction to numerical solution of two-dimensional problems
- Method of characteristics
- Finite-difference methods
- Linearization of nonlinear algebraic equations system
- Solution of linear algebraic equations system – direct and iterative approaches

Two-dimensional constituent transport
- General mass-conservation equation
- Depth-averaged mass-conservation equation
- Fractional-step method: advection and diffusion steps
- Boundary conditions
- Methods for solving advection-step equation
- Methods for solving diffusion-step equation
- Complete solution

Two-dimensional unsteady open-channel flow
- General mass- and momentum-conservation equation
- Depth-averaged mass- and momentum-conservation equation
- Fractional-step method: advection, diffusion, and propagation steps
- Boundary conditions
- Methods for solving advection-step equations
- Methods for solving diffusion-step equations
- Methods for solving propagation-step equations
- Complete solution

Assignments and term projects

Course topics are accompanied by assignments and term projects, requiring individual work under advisor's guidance and supervision.

Recommended literature:

1. M. Jovanovic: *Principles of 2D open-channel flow numerical modeling*, Civil Engineering Faculty Belgrade, 1998, In Serbian.

2. M. Spasojevic and F. M. Holly:*Two- and Three–Dimensional Numerical Simulation of Mobile-Bed Hydrodynamics and Sedimentation*, Chapter 15 in Sedimentation Engineering: Theories, Measurements, Modeling, and Practice, ASCE Manuals and Reports of Engineering Practice No. 110, Garcia, M., ed, American Society of Civil Engineers, 2007.