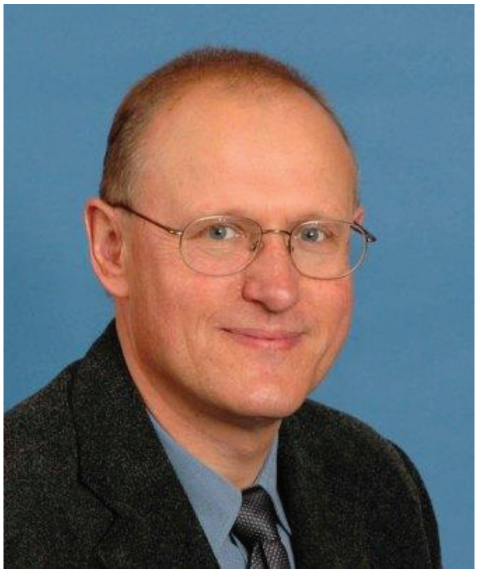
SAFL Seminar Series

Wednesday, Oct. 21, 2009, 3:30pm

St. Anthony Falls Laboratory ~ Auditorium



Hydrodynamics of aquatic ecosystems: An interface between Fluid Mechanics, Ecology, and Biomechanics

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Fifteen years ago a prominent lotic ecologist B. Statzner, a pioneer of hydraulics implementation in lotic ecology, stressed that "a broader incorporation of aspects of fluid dynamics into studies of various ecosystems will advance general ecological theory faster than past or current research routes, which largely ignore(d) the physical principles of moving air or water" (Statzner and Borchardt, 1994). Today's situation is not much different, highlighting the urgency of the truly interdisciplinary methodology. This talk is an attempt to further enhance and promote this approach as an emerging research area at the interfaces between environmental fluid mechanics, aquatic ecology, and biomechanics. This new area, Hydrodynamics of Aquatic Ecosystems, bridges these disciplines together and can be defined as a study of flow-organism interactions in running waters with particular focus on relevant transport processes and mutual physical impacts occurring at multiple scales from the sub-organism scale to the organism patch mosaic scale (comparable to the flow width). Being an important part of its mother disciplines, Hydrodynamics of Aquatic Ecosystems deals with two key interconnected issues: (i) physical interactions between flow and organisms (e.g., due to an interplay between flow-induced forces and reaction forces generated by organisms); and (ii) ecologically relevant mass-transfer-uptake processes (e.g., due to molecular and turbulent diffusion). Key concepts and tools of Hydrodynamics of Aquatic Ecosystems will be outlined first and then a promising approach that may provide a unifying platform for coupling and integrating ecological, hydrodynamic, and biomechanical processes, known as the double-averaging methodology (DAM), will be briefly discussed. The establishment of a new discipline Hydrodynamics of Aquatic Ecosystems should eliminate multiple knowledge gaps at the borders between fluid mechanics, ecology and biomechanics, i.e., areas where probability of new discoveries is the highest.

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