CIVIL AND ENVIRONMENTAL ENGINEERING

DIATI - Complex network-based analysis of transport processes and connectivity in multi-thread rivers

Funded By	Dipartimento DIATI
Supervisor	RIDOLFI LUCA - luca.ridolfi@polito.it
Contact	CAMPOREALE CARLO VINCENZO - carlo.camporeale@polito.it RIDOLFI LUCA - luca.ridolfi@polito.it
Context of the research activity	Multi-thread river systems (e.g., braided, anabranching, wandering, secondary channels) are widespread in nature, where they play a crucial role in numerous biotic and abiotic environmental processes. They exhibit complex network topologies, characterized by wide ranges of geometrical, hydraulic, and sediment link properties and remarkable spatiotemporal dynamics forced by flow stages. These features make multi-threaded rivers paradigmatic cases for studying connectivity in natural environments and how it influences major river transport processes (chemicals, sediments, seeds, nutrients, larvae, fishes, etc.). Added to this is the marked sensitivity of these river morphologies to climate-induced hydrological changes, with the strong risk of observing a reduction of multi-thread rivers in the coming decades and the consequent losses of ecosystem variety and alteration of fluvial transport processes, from the reach scale to the basin scale. Speculative interest, environmental importance, interactions with anthropic activities and fragility to climate change therefore explain the urgency of studying this class of rivers.
Objectives	The aim of the doctoral activity will be to understand and mathematically model the transport processes on rivers, highlighting how these processes depend on the connectivity structure, on the hydraulic and morphological characteristics of the network links, and evolve over time depending on hydrological fluctuations. To these aims, complex network theory-related tools will be also adopted. In addition to the theoretical activity, real cases will be studied (e.g. the Borbera river and the Tagliamento river), as well as field measurement activity will be planned. Publications on peer reviewed international journals are expected outcomes of the research work.
Skills and competencies for the development of	The competencies required for the projects include the basic-science field (physics and math), engineering principles (continuum mechanics, experimental data processing, statistics). Fundamental knowledge related to fluid mechanics is required. Knowledge of

the activity	complex network theory, numerical modelling, and Matlab are preferred skills.