FEM 2013
M.S. YALIN MEMORIAL **Mini-Colloquium on Fluvial Eco-Hydraulics and Morphodynamics: new insigths and challenges**
28-29 November, 2013 Palermo, Italy

A MATHEMATICAL MODEL FOR MEANDERING RIVERS WITH VARYING WIDTH

S. Lanzoni[1], A. Frascati[2]
[1] Department of Civil, Environmeltal and Architectural Engineering,University of Padova, Italy. *e-mail*: *stefano.lanzoni@unipd.it*
[2] Shell Global Solution International, Rijkswijk, Netherland.
e-mail: *alessandro.frascati@shell.com*

The aim of the present contribution is twofold: determining the complete linear response of a meandering river to spatially varying channel axis curvature and width, exploiting the ability of the model to describe the morphological tendencies of alluvial rivers; and developing a computationally efficient tool that can be easily incorporated in long-term planform evolution models. To this aim a two-dimensional mathematical model is developed that provides analytically the bed topography of an alluvial channel with arbitrary distributions of channel axis curvature and channel width under steady flow conditions. The centrifugally induced secondary (helical) flow associated with streamline curvatures is accounted for by a suitable parametrization based on the structure of the three-dimensional flow field. The relevant momentum ad mass conservation equation are then linearized by taking advantage of the fact that alluvial rivers often exhibit mild and long meander bends, as long as evident but relatively small width variations. The resulting analytical solution depends on the spatial distribution of both channel axis curvature and channel width variations, which can be easily extracted from topographical maps and aerial photographs. Further input data are the mean slope of the investigated river reach, the characteristic grain size of the sediment bed and the formative flow discharge. The comparison with the bed topography surveyed in a 21 km long reach of the Po River is very encouraging and support the use of the model to investigate how the river likely reacts to changes in planform geometry or external forcing.

References

Frascati, A., Lanzoni, S. (2013), A mathematical model for meandering rivers with varying width, J. Geophys. Res. Earth Surf., 118, doi:10.1002/jgrf.20084.