6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 15 June 2018, Glasgow, UK

# NUMERICAL SOLUTIONS FOR THE ONSET OF MOTION OF NON-SPHERICAL SEDIMENT PARTICLES ON INCLINED AND SEEPED BEDS

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**Key words:** *Incipient motion, Sloped beds, Ellipsoidal particles, Discrete element method, Seepage*

We present a numerical and an analytical approach to compute the onset of motion of non-spherical particles on inclined and seeped sediment beds. The numerical approach is based on the Discrete element method (DEM), suitable to simulate the micro-mechanic nature of the sediment grain motion. The analytical approach, although based on equilibrium equations, is essential for the right analysis and interpretation of the numerical approach and its corresponding results. Flow-particle interactions are modelled in both approaches by drag, lift and seepage forces with a one-way coupling technique since the incipient motion does not substantially modify the flow. The drag, lift and seepage forces take into account the ellipsoidal nature of the particles and its orientation.

The onset of motion is traditionally established as a relationship between the particle flow Reynolds number $Re^\star$ and the critical shear stress $\tau^\star$ that produces the initiation of motion, see [1] (Shields diagram). Experimental and previous analytical and numerical works assume that the particles are spherical, see [2] and [3], hypothesis that does not represent the real configuration of sediment beds.

This work enhances the previous works assuming the ellipsoidal shape of the sediment particles and extends the previous results for wide variety ellipsoidal shapes, bed inclinations and seepage conditions. Results cover a wide range of conditions for the onset of motion and are compared with the experiments, showing the ability of DEM to reproduce the results from the experiments even to configurations that have not been tested previously.

Acknowledgements: Research supported by Grant # BIA-2015-64994-P (MINECO/FEDER).

## REFERENCES

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