Wednesday 14th March and Thursday 15th March 2018, 9:00 am
Engineering Campus (Room B102)

Seminars within the frame-work the
International Research Training Group on the topics of
Droplet Interaction Technologies (GRK 2160, DROPIT),
in partnership with University of Stuttgart and University of Trento,
funded by Deutsche Forschungsgemeinschaft (DFG).

Understanding Dimensional Analysis

An interactive lecture given by
Prof. Bernhard Weigand, University of Stuttgart,
Faculty of Aerospace Engineering and Geodesy

Abstract:
Why can't a mouse in the size of an elephant stand without breaking its legs? And why can an ant carry multiples of its own weight while humans are barely able to carry more than their own weight? Is the reasoning somehow connected to the fact that the legs of a mouse are "relatively thin" or the weight of the elephant is "relatively large"? One would need to ask: "Relative to what?" Obviously, it appears rather meaningless to claim a length to be "relatively short" or a weight to be "relatively heavy" without defining a suitable scale. But what constitutes an appropriate scale and how may it be found?The way out of this dilemma is to simply compare the regarded length to another length scale, relevant to the problem of interest. Defining a length through its ratio to some problem related length scale, not only provides a unique numerical value, but it also becomes independent of whether one chooses to apply "millimeters" rather than "meters". These considerations are of course also true for all other physical quantities and their respective units.
Dimensional analysis holds great benefits, as physical problems can be significantly eased. Application of dimensional analysis removes unessential information from the regarded problem (namely the system of units), thus reducing the number of variables and therefore sharpening the insight to the essential physical mechanisms. In consequence it encourages a deeper understanding and insight to the physical processes. Besides the pure joy of cognition, the engineering task of constitutive and targeted design of technical processes is facilitated.
This lecture will provide an introduction into Dimensional Analysis. First some fundamentals will be given (like Bridgeman equation and Buckingham-Theorem). Then the application of the method will be shown for several examples ranging from mechanics, thermodynamics to fluid mechanics. Model theory will briefly discussed and self-similar solutions of problems will be addressed.

Wave system shown for a swimming duck (Wikipedia). This wave system can be analysed with the help of Dimensional Analysis.

The seminars are open to all and particularly dedicated to PhD students of ISA and TIM doctoral programmes.
For more information, please contact Prof. G.E. Cossali, cossali@unibg.it