Massachusetts Institute of Technology
Department of Mechanical Engineering

MMEC SEMINAR SERIES

Mechanics: Modelling, Experimentation, Computation

Tuesdays @ 4:00pm – Room 3-370 **December 02, 2014**

Universal Reynolds number of transition, self-organized criticality and turbulence modeling.

Victor Yakhot, *Boston University*

A high-Re turbulent flow involves velocity fluctuations excited in an extremely broad interval of wave numbers $k > \Lambda_f$ where Λ_f is a relatively small set of the wave-vectors where energy is pumped into fluid by external forces, instabilities etc. Iterative averaging over small-scale velocity fluctuations leads to an infinite number of "relevant" scale-dependent coupling constants (Reynolds numbers) $Re_n(k) = O(1)$, which is a part of "turbulence problem".

We have found that in the infrared limit $k \rightarrow \Lambda_f$, the Reynolds numbers $Re(k) \rightarrow Re_{tr}$ where Re_{tr} is the recently numerically and experimentally discovered *universal* Reynolds number of "smooth" transition from Gaussian to anomalous statistics of spatial velocity derivatives.

Therefore, the large-scale velocity field in a high-Reynolds number turbulent flow is marginally stable with the "dressed" Re-number equal to that at the transition point. This effect is called "self-organized criticality". The calculated relation $Re(\Lambda_f) = Re_{tr}$ "selects" the lowest - order non-linearity as the only relevant one leading to eective equations for large-scale features of high - Re turbulent flows widely used in engineering design.

Seminar Host: Kostya Turitsyn (turitsyn@mit.edu)

Please join us for ***refreshments beforehand, outside Room 3-370***

For more information, visit our website at http://web.mit.edu/mmec/
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