Centre for Contemporary Studies

Invites you to a talk on:

Galileo, Carnot and the Physics of Computation

Speaker:

Prof. Edward Fredkin

Visiting Research Professional at Robotics Institute
Carnegie Mellon University, USA

Friday, 8th Jan 2010, Time: 4:00 pm

Venue: CCS Seminar Hall, IISc, Bangalore 12

(Formerly TIFR mathematics Building)

Tea/Coffee will be served at 3:30 pm

Two of the wonderful ground rules for the development of newly invented science, utilized by both Galileo and Carnot, are the concepts of studying a closed system, and further, studying a system without friction. The logic is simple and straightforward: If we want to find a law of nature, then our experiments, whether carried out or simply imagined, are greatly simplified by eliminating forces or energy flow between the "outside" and the "inside" of the closed system. One way of accomplishing this is to imagine that the temporal evolution of state takes place without friction, which could contaminate the observed data by converting energy of motion into lost heat.

Both falling objects and thermal engines undergo temporal evolution of state; which means that they share that property with physics in general. As to friction, systems from the scale of gravitationally bound collections of Galaxies down to molecules and atoms, all operate with essentially zero friction. The most important property of such systems is that the laws that constrain their temporal evolution are generally exactly reversible.

On the other hand, the operation of nearly all theoretical models of computation, from the automata theory to Turing machines to general computer science are not merely contaminated by friction but they are totally dominated by friction; obscuring any possible connections between the functions of theoretical models of computation and theoretical physics. All of the Boolean gates in ordinary computers are necessarily always converting energy into heat

By merely emulating what Galileo and Carnot might have done if computers had been introduced back then, we can finally make that connection between digital computation and theoretical physics.

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