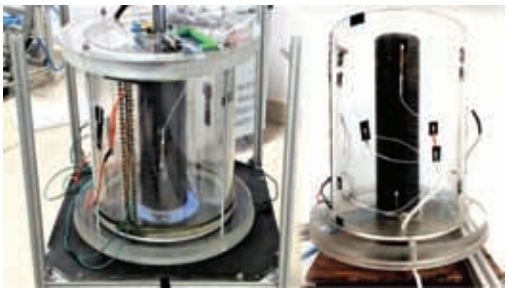
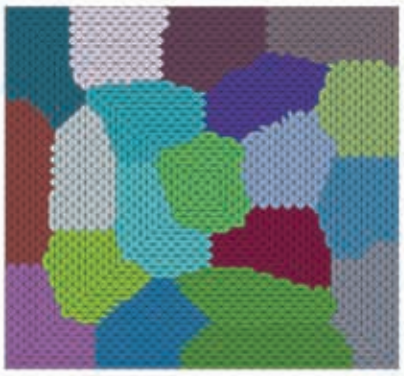
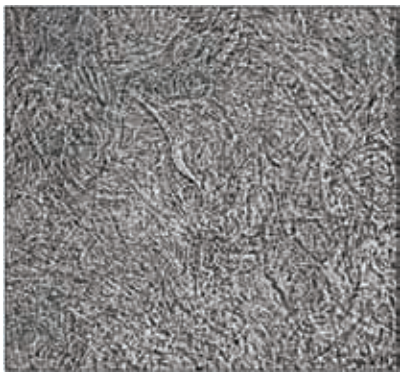
Left: Rotating apparatus designed to simulate thermal core-mantle coupling in the Earth. Right: Concentric cylinder assembly, which forms part of the rotating apparatus designed to simulate thermal core-mantle coupling in the Earth (Aujogue K, Pothérat A, Bates I, Debray F and **Sreenivasan B.** Little Earth Experiment: An Instrument to Model Planetary Cores. *Review of Scientific Instruments.* 2016. 87:084502).





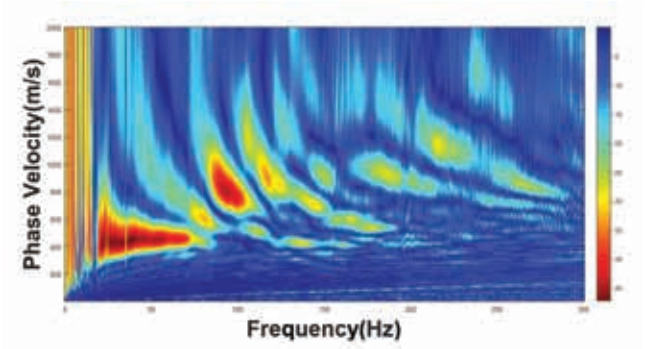
When a system becomes more complex, predicting its behaviour becomes computationally daunting. This problem has now been addressed by decomposing the physical domain, thus increasing the computation speed (Pranesh S and **Ghosh D.** Addressing the Curse of Dimensionality in SSFEM Using the Dependence of Eigenvalues in KL Expansion on Domain Size. *Computational Methods in Applied Mechanics and Engineering.* 2016. 311:457-475).

An instantaneous laser shadowgraph used in the intensity measurements in the study of light propagation through buoyancy driven turbulence. This study investigated how light is distorted as it passes through atmospheric turbulence (Pawar SS and **Arakeri JH.** Intensity and Angle-of-Arrival Spectra of Laser Light Propagating through Axially Homogeneous Buoyancy-Driven Turbulence. 2016. *Applied Optics*. 55(22): 5945-5952).

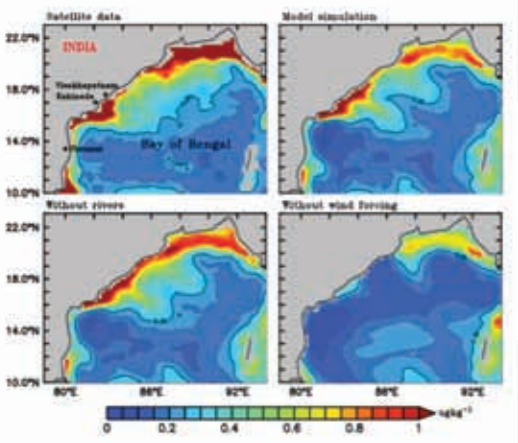


RESEARCH SNAPSHOTS 2016

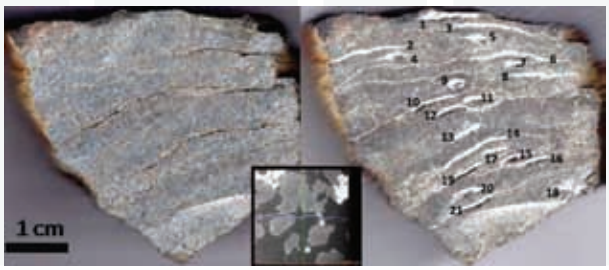
To understand the dynamic properties of a medium just below the surface of the ground, a novel approach has been proposed that accurately computes the theoretical dispersion spectra for the various modes of wave propagation (**Kumar J** and Naskar T. A Fast and Accurate Method to Compute Dispersion Spectra for Layered Media using a Modified Kausel-Roësset Stiffness Matrix Approach. *Soil Dynamics and Earthquake Engineering.* 2017. 92:176-182).



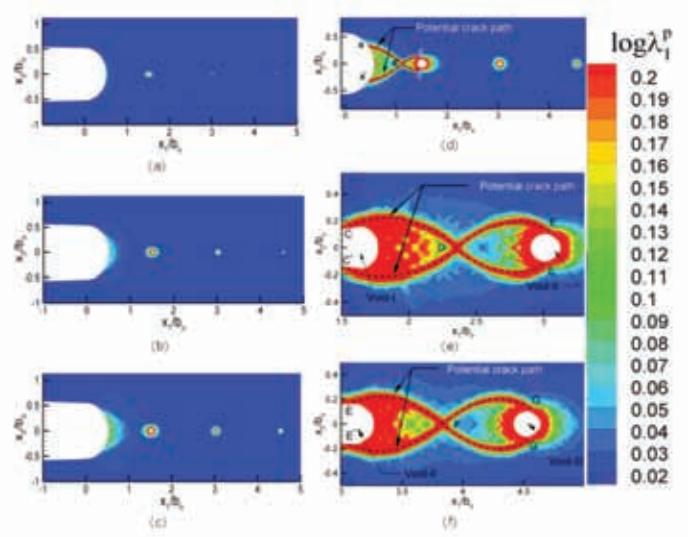
A recently upgraded 9kW$_z$ Building Integrated Photovoltaic system (BIPV) facility with an inset of indoor natural lighting (Aaditya G and **Mani M.** BIPV: A Real-Time Building Performance Study for a Roof-Integrated Facility. *International Journal of Sustainable Energy.* 2016. 35:1-19).



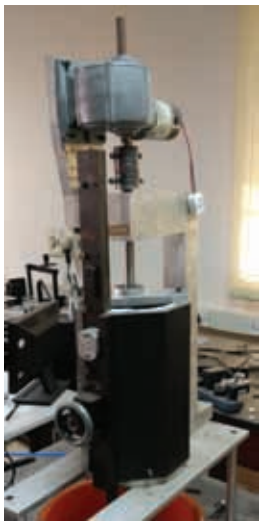
A phytoplankton bloom makes a dramatic summer appearance in the Bay of Bengal (top left). The other panels show simulated bloom formation using a coupled physical-biological ocean model (Thushara V and **Vinayachandran PN.** Formation of summer phytoplankton bloom in the northwestern Bay of Bengal in a coupled physical-ecosystem model. *Journal of Geophysical Research: Oceans.* 2016. 121(12): 8535–8550).



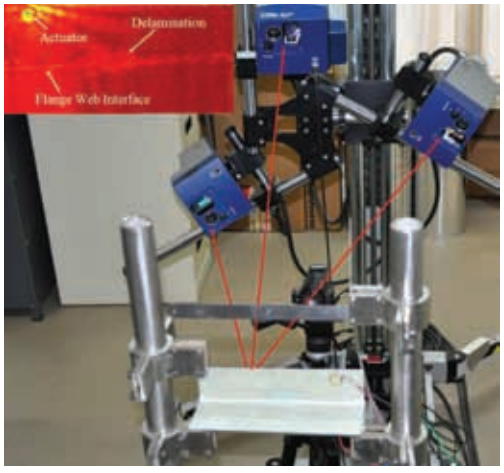
Spheroidal weathering of a diabase in hand-specimen scale. (Banerjee A, **Chakrabarti R** and Mandal S. Geochemical Anatomy of a Spheroidally Weathered Diabase. *Chemical Geology.* 2016. 440:124-138).



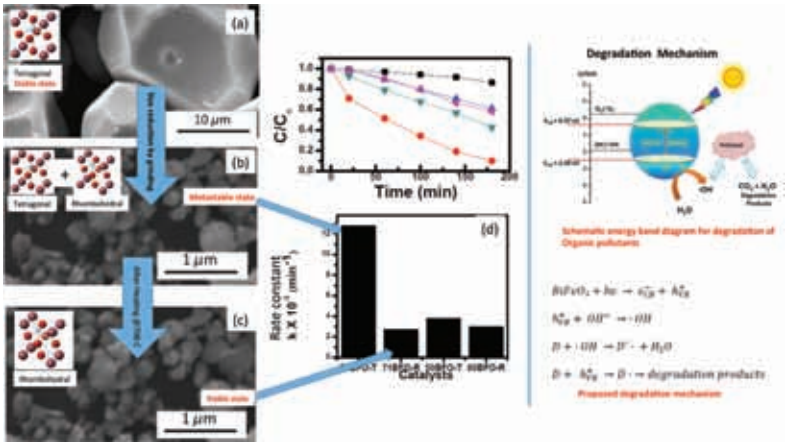
Fracture mechanism in brittle bulk metallic glasses. Cavitation in weak zones followed by coalescence through curved shear bands give rise to nanocorrugations on fracture surface (Singh I, **Narasimhan R** and Ramamurty U. Cavitation-Induced Fracture Causes Nanocorrugations in Brittle Metallic Glasses. *Phys. Rev. Lett.* 117(4): 044302).



The Couette Cell and apparatus to conduct experiments to understand vortex flow in sheared granular materials (Krishnaraj KP and **Nott PR.** A Dilation-Driven Vortex Flow in Sheared Granular Materials Explains a Rheometric Anomaly. *Nature Communications*. 2016. 7:10630).



Remote monitoring of structures with laser Doppler ultrasound; image shows a 3D Laser scanning of a composite structural joint with hidden damage. Inset shows the hidden damage detected with the help of a new technique of ultrasound Doppler imaging and computation (Geetha GK, **Mahapatra DR,** Gopalakrishnan S, Hanagud S. Laser Doppler imaging of delamination in a composite T-joint with remotely located ultrasonic actuators. *Composite Structures.* 2016. 147:197-210).



A semiconducting ferroelectric material $BiFeO_3$-$PbTiO_3$ shows a tetragonal stable phase for large grains (~ 10 microns) (a) When the grains were reduced to ~ 0.5 micron by manual grinding at room temperature (b), a minor rhombohedral phase appeared which coexists with the majority tetragonal phase. On heating this ground powder above the Curie point (~ 650°C) and cooling back to room temperature, the major tetragonal phase vanished completely and the rhombohedral phase becomes stabilized (c). This proved that the tetragonal phase in the ground small grains is metastable in nature. The powders with metastable tetragonal phase and stable rhombohedral phase were used as photocatalysts for degradation of a typical organic pollutants, Rhodamine B. We found that the degradation rate increased five times when the catalysts were in the metastable state (d) (Narayan B, Adhikari S, Madras G and **Ranjan R.** Trapping a Metastable Ferroelectric Phase by Size Reduction in Semiconducting Ferroelectric $BiFeO_3$-$PbTiO_3$ and its Implications for Photocatalytic Response. *Physical Review Applied.* 2017. 7:024018).

RESEARCH HIGHLIGHTS

The Division consists of departments of Aerospace Engineering (which includes DRDL-IISc Joint Advanced Technology Programme and ISRO-IISc Space Technology Cell), Civil Engineering, Chemical Engineering, Materials Engineering, Mechanical Engineering, Centre for Atmospheric & Oceanic Sciences, Centre for Earth Sciences, Centre for Product Design and Manufacturing, Centre for Sustainable Technologies and Divecha Centre For Climate Change.