



Indian Association of
Structural Engineers



IAStructE Cordially Invites you for a
LECTURE on

Beyond the First Shock: Sequence-Aware Structural Resilience under Earthquake Doublets

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Dr. Ajay Chourasia is Chief Scientist and Group Leader, Structural Engineering & 3D Concrete Printing Division, CSIR-CBRI, Roorkee, with over three decades of expertise in structural and earthquake engineering. His specializations include earthquake-resistant design, structural dynamics, health monitoring, seismic retrofitting, confined masonry, resilient construction, and 3D Concrete Printing. He has authored 200+ technical publications, 175+ institutional reports, and 20 books, and holds seven patents. His work significantly contributes to national standards, disaster risk reduction, policy advisory, post-earthquake reconstruction, and resilient infrastructure development.

Brief About the Topic

Seismic design codes, including IS 1893, assume that a structure faces a single design earthquake, followed by a safe interval for inspection and repair. The northern Venezuela sequence of 24 June 2026, in which an Mw 7.5 rupture followed an Mw 7.2 event within about 39 seconds, shows how fragile that assumption is.

This lecture places Venezuela within a global catalogue of damaging doublets, from Assisi, Tangshan and Mexico City to Kahramanmaraş, Kumamoto, Canterbury and Gorkha. In these events, second shocks, often smaller ones, collapsed weakened buildings and killed occupants, inspectors and rescuers.

The lecture then examines what changes inside a structure after the first shock and presents a sequence-aware framework. The framework combines state-dependent stiffness and strength ratios, a residual capacity index, an updated P–Δ stability check and time-dependent aftershock hazard. It uses two-stage nonlinear response-history analysis in which the damaged model is never reset, with record pairs selected according to sequence classes linked to inspection opportunity. An illustrative example shows how a second shock 30% below intact capacity can still exceed a damaged frame's remaining strength.

The lecture concludes with implications for detailing, rescue and re-entry protocols, the Himalayan precedent, and directions for Indian standards and a national research programme. Its central message is that earthquake safety is a time-dependent condition, not a single-event property

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