

## Special Colloquium

### *Unified tests for functional concurrent linear models and the phase transition from sparse to dense functional data*

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**Abstract:** We consider the problem of testing functional constraints in a class of functional concurrent linear models where both the predictors and the response are functional data measured at discrete time points. We propose test procedures based on the empirical likelihood with bias-corrected estimating equations to conduct both pointwise and simultaneous inferences. The asymptotic distributions of the test statistics are derived under the null and local alternative hypotheses, where sparse and dense functional data are considered in a unified framework. We find a phase transition in the asymptotic null distributions and the orders of detectable alternatives from sparse to dense functional data. Specifically, the proposed tests can detect alternatives of root- $n$  order when the number of repeated measurements per curve is of an order larger than  $n^{\eta_0}$  with  $n$  being the number of curves. The transition points  $\eta_0$  for pointwise and simultaneous tests are different and both are smaller than the transition point in the estimation problem. Simulation studies and real data analyses are conducted to demonstrate the proposed methods.

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