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Sommario/riassunto	This set of extensive tutorial reviews and lectures focusses on the semi-classical and quantum aspects of percolation methods and their application to breakdown phenomena in disordered composite or granular materials. It sets out to connect - for the first time and in a coherent fashion - many recent theoretical and experimental advances in adjacent fields, such as the investigation of nonlinear current-voltage characteristics of 'quantum-dotted' materials or Zener breakdown in Mott or Anderson insulators. Last but not least, a final chapter explores the application of quantum percolation methods to the rapidly emerging field of quantum computing and communication.

