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UNIFORM STABILITY OF STOCHASTIC IMPULSIVE SYSTEMS: A NEW COMPARISON METHOD

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Abstract. This paper studies uniform stability problems of stochastic impulsive systems by using a new comparison method. We firstly establish a comparison principle between the stochastic impulsive system and its scalar comparison system. Based on the obtained comparison result, uniform stability and uniform asymptotic stability of stochastic impulsive systems are established by analyzing those of comparison systems. Finally, a numerical example of a power system with random perturbations is presented to illustrate our results.

Keywords. impulsive effects, comparison principle, stochastic stability, stochastic impulsive system.

There are a variety of impulsive factors in real world systems which cause the states' abrupt changes at certain moments of time. For example, when a ball is bouncing back from the ground, the velocity changes sharply due to the impulsive force. Such evolution process with this kind of discontinuous dynamic behaviors can be described by an impulsive system which has been used in a variety of fields including medicine, biology, economics, and engineering. Moreover, many results of analysis and control of these impulsive systems can be found in the literature, see [1]-[4] and the references therein. On the other hand, besides impulsive behaviors, stochastic effects likewise can always be found in these systems as well. These random/stochastic behaviors, which produce randomness and uncertainty in one or more parts of the evolution processes, can be modelled as a stochastic system. For any given input, the stochastic system does not always produce the same output. A few components of systems which can be stochastic in nature include stochastic inputs, random time-delays, disturbances, and even stochastic dynamic processes [5], which can be applied in many disciples such as neural networks [11]. In fact, for those dynamical systems involving both stochastic characteristics and abrupt state changes, such as stochastic failures of the components, sudden environment changes and sharp changes in stochastic