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An extended birth-death $Q$-matrix with instantaneous state and catastrophes. II. (Chinese. English summary) [Zbl 1043.60061]

[For part I see ibid. 24, No. 2, 187–192 (2003; Zbl 1036.60075).]

Summary: A new structure with the special property that instantaneous state and catastrophes are imposed to ordinary birth-death processes is considered. Under the condition that the underlying birth-death process is non-zero-exit, the authors are able to give easy-checking existence criteria for such Markov processes. All the $Q$-processes and all the honest $Q$-processes are explicitly constructed. Recurrent and ergodicity properties for the honest $Q$-processes are investigated. Surprisingly, it can be proved that all the honest $Q$-processes are ergodicity without necessarily imposing any extra conditions. Ergodicity of such processes is also investigated and solved. Equilibrium distributions are established. A condition that the honest $Q$-processes are symmetric is given. Two examples are provided to illustrate our results.

MSC:
60J27 Continuous-time Markov processes on discrete state spaces
60J99 Markov processes

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instantaneous state; extended birth-death $Q$-process; construction theorem; existence; ergodicity