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**A linear quadratic model based on multistage uncertain random systems.** (English)

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Summary: In this paper, a linear quadratic (LQ) optimal control model is studied for a multistage uncertain random system. First, recurrence equations are presented for this model based on Bellman's principle. Second, analytical expressions are derived for solving both the optimal objective function and the optimal control strategy of the model. Finally, an example is given to illustrate our results.

**MSC:**

- 93C41 Control/observation systems with incomplete information
- 93E03 Stochastic systems in control theory (general)
- 49N10 Linear-quadratic optimal control problems

**Keywords:**

linear quadratic; optimal control; uncertain random system

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**References:**

- [1] Bismut, J. M., Linear quadratic optimal stochastic control with random coefficients, SIAM J. Control Optim., 14, 3, 419-444, (1976) · [Zbl 0331.93086](#)
- [2] Bensoussan, A., A Stochastic Control of Partially Observed Systems, (1992), Cambridge University Press: Cambridge University Press Cambridge, UK
- [3] Chen, S.; Li, X.; Zhou, X. Y., Stochastic linear quadratic regulators with indefinite control weight costs, SIAM J. Control Optim., 36, 5, 1685-1702, (1998) · [Zbl 0916.93084](#)
- [4] Chen, Y.; Zhu, Y., Indefinite LQ optimal control with equality constraint for discrete-time uncertain systems, Jpn. J. Ind. Appl. Math., 33, 2, 361-378, (2016) · [Zbl 1353.49046](#)
- [5] Davis, M. H.A., Linear Estimation and Stochastic Control, (1977), Chapman and Hall: Chapman and Hall London · [Zbl 0437.60001](#)
- [6] Deng, L.; You, Z.; Chen, Y., Optimistic value model of multidimensional uncertain optimal control with jump, Eur. J. Control, 39, 1-7, (2018) · [Zbl 1380.93286](#)
- [7] Deng, L.; Zhu, Y., Uncertain optimal control with jump, ICIC Express Lett. Part B: Appl., 3, 2, 419-424, (2012)
- [8] Kalman, R. E., Contributions to the theory of optimal control, Boletín de la Sociedad Matemática Mexicana, 5, 2, 102-119, (1960)
- [9] Kang, Y.; Zhu, Y., Bang-bang optimal control for multi-stage uncertain systems, Inf.: Int. Interdiscip. J., 15, 8, 3229-3237, (2012) · [Zbl 1323.49014](#)
- [10] Liu, B., Uncertainty Theory, (2007), Springer-Verlag: Springer-Verlag Berlin
- [11] Liu, B., Uncertainty Theory: A Branch of Mathematics for Modeling Human Uncertainty, (2010), Springer-Verlag: Springer-Verlag Berlin
- [12] Liu, B., Why is there a need for uncertainty theory, J. Uncertain Syst., 6, 1, 3-10, (2012)
- [13] Liu, B., Uncertain random graphs and uncertain random networks, J. Uncertain Syst., 8, 1, 3-12, (2014)
- [14] Liu, Y., Uncertain random programming with applications, Fuzzy Optim. Decis. Mak., 12, 2, 153-169, (2013) · [Zbl 1428.90194](#)
- [15] Liu, Y., Uncertain random variables: A mixture of uncertainty and randomness, Soft Comput., 17, 4, 625-634, (2013) · [Zbl 1281.60005](#)
- [16] Liu, Y., Risk index in uncertain random risk analysis, Int. J. Uncertain. Fuzz. Knowl.-Based Syst., 22, 4, 491-504, (2014) · [Zbl 1323.62102](#)
- [17] Sheng, Y.; Yao, K., Some formulas of variance of uncertain random variable, J. Uncertain. Anal. Appl., 2, 1, 12, (2014)
- [18] Wen, M.; Kang, R., Reliability analysis in uncertain random system, Fuzzy Optim. Decis. Mak., 2, 3, 1-16, (2016)
- [19] Wonham, W. M., On a matrix Riccati equation of stochastic control, SIAM J. Control, 6, 4, 681-697, (1968) · [Zbl 0182.20803](#)

- [20] Wu, H.; Zhou, X. Y., Characterizing all optimal controls for an indefinite stochastic linear quadratic control problem, *IEEE Trans. Autom. Control*, 47, 7, 1119-1122, (2002) · [Zbl 1364.49044](#)
- [21] Xu, X.; Zhu, Y., Uncertain bang-bang control for continuous time model, *Cybern. Syst.*, 43, 6, 515-527, (2012) · [Zbl 1331.93228](#)
- [22] Yan, H.; Sun, Y.; Zhu, Y., A linear-quadratic control problem of uncertain discrete-time switched systems, *J. Ind. Manag. Optim.*, 13, 1, 267-282, (2017) · [Zbl 1368.49041](#)
- [23] Yao, K.; Gao, J., Law of large numbers for uncertain random variables, *IEEE Trans. Fuzzy Syst.*, 24, 3, 615-621, (2016)
- [24] K. Yao, Z. Qin, An uncertain control model with application to production-inventory system, in: *Proceedings of the Twelfth Asia Pacific Industrial Engineering and Management Systems Conference*, Beijing, China, 2011, pp. 927-977.
- [25] Zhang, W.; Li, G., Discrete-time indefinite stochastic linear quadratic optimal control with second moment constraints, *Proceedings of the Mathematical Problems in Engineering*, 2014, 9, (2014) · [Zbl 1407.93435](#)
- [26] Zhou, X. Y.; Li, D., Continuous-time mean-variance portfolio selection: a stochastic LQ framework, *Appl. Math. Optim.*, 42, 1, 19-33, (2000) · [Zbl 0998.91023](#)
- [27] Zhu, Y., Uncertain optimal control with application to a portfolio selection model, *Cybern.Syst.*, 41, 7, 535-547, (2010) · [Zbl 1225.93121](#)
- [28] Zhu, Y., Fuzzy optimal control for multistage fuzzy systems, *IEEE Trans. Syst. Man Cybern.: Part B*, 41, 4, 964-975, (2011)
- [29] Zhu, Y., Functions of uncertain variables and uncertain programming, *J. Uncertain. Syst.*, 6, 4, 278-288, (2012)

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