van Houtum, G. J.; **Inderfurth, K.**; **Zijm, W. H. M.**
Materials coordination in stochastic multi-echelon systems. (English) Zbl 0955.90502
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Summary: This paper reviews the theoretical and numerical analysis of stochastic multi-echelon systems. We discuss both production (assembly) and distribution models, with an emphasis on materials coordination problems. Extensions to capacitated systems are also treated. The emphasis of this paper is on applicability of the models; in particular we characterize environments where multi-echelon models naturally fit. In particular, we discuss numerical procedures which allow for a quick and accurate evaluation of systems of realistic size and show how to use them to arrive at target service levels in serial and assembly systems. Extensions to capacitated systems and more flexible production environments are also discussed.

MSC:

90B05 Inventory, storage, reservoirs

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References:

[1] Axsäter, S.; Rosling, K., Installation versus echelon stock policies for multi-level inventory control, Management science, 39, 1274-1280, (1993) · Zbl 0798.90030

[2] Axsäter, S.; Rosling, K., Multi-level production/inventory control: material requirements planning or reorder point policies?, European journal of operations research, 75, 405-412, (1994) · Zbl 0804.90036

[3] Chen, F.; Zheng, Y.S., Evaluating echelon stock (R,nq) policies in serial production/inventory systems with stochastic demand, Management science, 40, 1262-1275, (1994) · Zbl 0822.90043

[4] Chen, F.; Zheng, Y.S., Lower bounds for multi-echelon stochastic inventory systems, Management science, 40, 1426-1443, (1994) · Zbl 0823.90034

[5] Clark, A.J.; Scarf, H., Optimal policies for a multiechelon inventory problem, Management science, 6, 475-490, (1960)

[6] Clark, A.J.; Scarf, H., Approximate solutions to a simple multi-echelon inventory problem, (), 88-100 · Zbl 0137.38404

[7] Cohen, M.A.; Lee, H.L., Strategic analysis of integrated production-distribution systems: models and methods, Operations research, 36, 216-228, (1988)

[8] De Kok, A.G., A moment-iteration method for approximating the waiting-time characteristics of the GI|G|1 queue, Probability in the engineering and informational sciences, 3, 273-287, (1989) · Zbl 1134.60414

[9] De Kok, A.G., Hierarchical production planning for consumer goods, European journal of operational research, 45, 55-69, (1990) · Zbl 0685.90049

[10] De Kok, A.G., Lagodimos, A.G., and Seidel, H.P., "Stock allocation in a two-echelon distribution network under service-constraints", Research Report THE/BDK/LBS, Graduate School of Industrial Engineering and Management Science, Eindhoven University of Technology, Eindhoven, The Netherlands.

[11] De Kok, A.G.; Seidel, H., Analysis of stock allocation in a two echelon distribution system, ()

[12] Diks, E.B.; De Kok, A.G.; Lagodimos, A.G., Multiechelon systems: A service measure perspective, European journal of operational research, 95, 241-264, (1996) · Zbl 0944.90501

[13] Eppen, G.; Schrage, L., Centralized ordering policies in a multi-warehouse system with lead times and random demand, (), 51-67

[14] Federgruen, A., Centralized planning models for multiechelon inventory systems under uncertainty, (), 133-173

[15] Federgruen, A.; Zipkin, P.H., Allocation policies and cost approximations for multi-location inventory systems, Naval research logistics quarterly, 31, 97-131, (1984) · Zbl 0529.90030

[16] Federgruen, A.; Zipkin, P.H., Approximation of dynamic, multi-location production and inventory problems, Management

science, 30, 69-84, (1984) · Zbl 0551.90019

[17] Federgruen, A.; Zipkin, P.H., Computational issues in an infinite-horizon, multi-echelon inventory model, Operations research, 32, 818-836, (1984) · Zbl 0546.90026

[18] Federgruen, A.; Zipkin, P.H., An inventory model with limited production capacity and uncertain demands, I. the average cost criterion, Mathematics of operations research, 11, 193-207, (1986) · Zbl 0602.90053

[19] Federgruen, A.; Zipkin, P.H., An inventory model with limited production capacity and uncertain demands, II. the discounted cost criterion, Mathematics of operations research, 11, 208-216, (1986) · Zbl 0628.90017

[20] Forrester, J.W., Industrial dynamics, (1961), MIT Press Cambridge, MA

[21] Glasserman, P.; Tayur, S.R., Sensitivity analysis for base-stock levels in multi-echelon production-inventory systems, Management science, 41, 263-281, (1995) · Zbl 0832.90051

[22] Glasserman, P., Bounds and asymptotics for planning critical safety stocks, Operations research, 44, (1996)

[23] Glasserman, P.; Tayur, S.R., A simple approximation for a multistage capacitated production-inventory system, Naval research logistics, 43, 41-58, (1996) · Zbl 0870.90064

[24] Hax, A.C.; Candea, D., Production and inventory management, (1984), Prentice-Hall Englewood Cliffs, NJ

[25] Inderfurth, K., Safety stock optimization in multi-stage inventory systems, International journal of production economics, 24, 103-113, (1991)

[26] Inderfurth, K., Valuation of leadtime reduction in multistage production systems, (), 413-427

[27] Inderfurth, K., Erratum to: 'safety stocks in multistage divergent inventory systems: A survey', International journal of production economics, 37, 287-288, (1994)

[28] Inderfurth, K., Safety stocks in multistage divergent inventory systems: A survey, International journal of production economics, 35, 321-329, (1994)

[29] Inderfurth, K., Multistage safety stock planning with item demands correlated across products and through time, Production and operations management, 4, 127-144, (1995)

[30] Inderfurth, K.; Minner, S., Safety stocks in multi-stage inventory systems under different service levels, ()

[31] Jönsson, H.; Silver, E.A., Analysis of a two-echelon inventory control system with complete redistribution, Management science, 33, 880-895, (1987) · Zbl 0612.90022

[32] Jönsson, H.; Silver, E.A., Stock allocation among a central warehouse and identical regional warehouses in a particular push inventory control system, International journal of production research, 25, 191-205, (1987) · Zbl 0612.90032

[33] Karmarkar, U.S., Lot sizes, lead times and in-process inventories, Management science, 33, 409-418, (1987) · Zbl 0612.90068

[34] Lambrecht, M.R.; Muckstadt, J.A.; Luyten, R., Protective stocks in multi-stage production systems, International journal of production research, 22, 1001-1025, (1984) · Zbl 0551.90039

[35] Langenhoff, L.J.G.; Zijm, W.H.M., An analytical theory of multi-echelon production/distribution systems, Statistica neerlandica, 44, 149-174, (1990) · Zbl 0717.90025

[36] Lee, Y.J.; Zipkin, P.H., Tandem queues with planned inventories, Operations research, 40, 936-947, (1992) · Zbl 0758.90025

[37] Lee, Y.J.; Zipkin, P.H., Processing networks with inventories: sequential refinement systems, Operations research, 43, 1025-1036, (1995) · Zbl 0852.90085

[38] Minner, S., Dynamic programming algorithms for multistage safety stock optimization, () · Zbl 0888.90048

[39] Nahmias, S., Managing repairable items inventory systems: A review, (), 253-277

[40] Orlicky, J.A., Materials requirements planning, (1975), McGraw-Hill New York

[41] Rosling, K., Optimal inventory policies for assembly systems under random demands, Operations research, 37, 565-579, (1989) · Zbl 0677.90025

[42] Schassberger, R., Warteschlangen, (1973), Springer-Verlag Berlin · Zbl 0274.60077

[43] Schmidt, C.P.; Nahmias, S., Optimal policy for a two-stage assembly system under random demand, Operations research, 33, 1130-1145, (1985) · Zbl 0601.90042

[44] Simpson, K., In-process inventories, Operations research, 6, 863-873, (1958)

[45] Speck, C.J.; Van der Wal, J., The capacitated multiechelon inventory system with serial structure: 1. the 'push ahead'-effect, ()

[46] Speck, C.J.; Van der Wal, J., The capacitated multiechelon inventory system with serial structure: 2. an average cost approximation method, ()

[47] Tayur, S.R., Computing the optimal policy for capacitated inventory models, Communications in statistics-stochastic models, 9, 585-598, (1993) · Zbl 0804.90038

[48] Tijms, H.C., Stochastic models: an algorithmic approach, (1994), Wiley New York · Zbl 0838.60075

[49] Van Donselaar, K., Integral stock norms in divergent systems with lot-sizes, European journal of operational research, 45, 70-84, (1990) · Zbl 0697.90024

[50] Van Donselaar, K.; Wijngaard, J., Commonality and safety stocks, Engineering costs and production economics, 12, 197-204, (1987)

[51] Van Houtum, G.J., Theoretische en numerieke analyse Van multi-echelon voorraadsystemen met lijn- of assemblagestruktuur, (), (In Dutch)

[52] Van Houtum, G.J.; Zijm, W.H.M., Computational procedures for stochastic multi-echelon production systems, International journal of production economics, 23, 223-237, (1991)

[53] Veatch, M.H.; Wein, L.M., Optimal control of a two-station tandem production/inventory system, Operations research, 42, 337-350, (1994) · Zbl 0805.90055

[54] Verrijdt, J.H.C.M.; De Kok, A.G., Distribution planning for a divergent 2-echelon network without intermediate stocks under service restrictions, European journal of operational research, 89, 341-354, (1996) · Zbl 0913.90096

[55] Wight, O., MRP II — unlocking America's productivity potential, (1981), Oliver Wight Limited Publications Essex Junction

[56] Wijngaard, J.; Wortmann, J.C., MRP and inventories, European journal of operational research, 20, 281-293, (1985) · Zbl 0582.90043

[57] Zijm, W.H.M.; Van Houtum, G.J., On multi-stage production/inventory systems under stochastic demand, International journal of production economics, 35, 391-400, (1994)

[58] Zipkin, P.H., On the imbalance of inventories in multiechelon systems, Mathematics of operations research, 9, 402-423, (1984) · Zbl 0555.90033