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A More Effective Technique of Design Synthesis for MEMS with Expected Performance

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ABSTRACT

A design synthesis technique based on sensitivity for Micro-Electro-Mechanical Systems (MEMS) proposed. This new technique can be called Sensitivity-Based Direct Solution Algorithm (DSA) of design synthesis for MEMS with expected performance. Design synthesis with expected performance is regarded as a reverse problem of MEMS analysis. Behavior equation group can be deduced from analysis equations. Solving the behavior equation group only need L design variables, L is number of desired behaviors. This behavior equation group can be solved using any solution algorithm of non-linear equation group. Newton Iteration Method based on sensitivity is adopted. Comparing with Genetic Optimization Algorithm (GA) and Simulated Annealing Optimization Algorithm (SA), computational workload of DSA is greatly decreased. For instance, synthesis computation of a meandering resonator only needs 4 iterations (17 analyses); computational time is decreased from 7~8 hours to less than 30 seconds.

KEYWORDS

MEMS, Design Synthesis, Direct Solution Algorithm, Genetic Algorithms, Simulated, Annealing, Comparing

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References

- [1] N. Zhou and M. Agogino, "Automated design synthesis for Micro-Electro-Mechanical Systems (MEMS)," The Proceedings of the ASME Design Automation Conference, Montreal, Canada, 2002.
- [2] Q. Jing, H. Luo, T. Mukherjee, L. R. Carley, and G. Fedder, "CMOS micro-mechanical bandpass filter design using a hierarchical MEMS circuit library," Proceedings IEEE Thirteenth Annual International Conference on Micro Electro Mechanical Systems, Miyazaki, Japan, pp. 187– 192, 2000.
- [3] E. Goldberg, "Genetic algorithms in search, optimization, and machine learning," Addison-Wesley, 1989.
- [4] H. Li and E. Antonsson, "Evolutionary techniques in MEMS synthesis," Proceedings of DETC' 98, 1998 ASME Design Engineering Technical Conferences, Atlanta, GA, 1998.
- [5] T. Lacksonen, "Empirical comparison of search algorithms for discrete event simulation," Computers & Industrial Engineering, Vol. 40, No. 1– 2, pp. 133– 48, June 2001.
- [6] N. Zhou, V. Clark, and K. Pister, "Nodal simulation for MEMS design using SUGER v.0.5," In 1998 International Conference on Modeling and Simulation of Microsystems Semiconductors, Sensors and Actuators Santa Clara, CA, April 6– 8, pp. 308– 313, 1998.
- [7] J. Clark, N. Zhou, S. Bhave, Z. Bai, J. Demmel, and K. Pister, "Sugar: Advancements in a 3D multi-domain simulation package for MEMS," In Proceedings of the Microscale Systems: Mechanics and Measurements Symposium, Portland, OR, June 4, 2001.
- [8] J. Clark, N. Zhou, D. Bindel, L. Schenato, W. Wu, J. Demmel, and K. Pister, "3D MEMS simulation

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modeling using modified nodal" In Proceedings of the Microscale Systems: Mechanics and Measurements Symposium, pp. 68– 75, 2005.

- [9] N. Zhou, B. Zhu, A. Agogino, K. Pister, " Evolutionary synthesis of micro-electro-mechanical systems (MEMS)," Proceedings of ANNIE 2001: IEEE Neural Networks Council and Smart Engineering Systems Laboratory. ASME Press, St. Louis, Missouri, Vol. 11, pp. 197– 202, November 4– 7, 2003.
- [10] S. Narayanan and S. Azarm, " On improving multi-objective genetic algorithms for design optimization," Structural Optimization, Vol. 18, pp. 146– 155, 1999.
- [11] S. Chen, " Design & optimization of truss with expected deformed shape," China Civil Engineering Journal, Vol. 20, No. 2, pp. 1– 9, 1987.
- [12] S. Chen and S. Ye, " A guide-weight criterion method for the optimum design of antenna structures," Engineering Optimization, Vol. 10, No. 3, pp. 199– 127, 1987.
- [13] S. Chen, " Modern design methods of precise complex structures," Press of Beijing University of Aeronautics and Astronautics, Beijing, 1992.