

Acknowledgments

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References

1. D.L. Parnas, "Designing Software for Ease of Extension and Contraction," *IEEE Trans. Software Engineering*, Vol. 5, No. 2, Mar. 1979, pp. 128-138.
2. G. Booch, "Object-Oriented Design," *Software Engineering with Ada*, 1983, Benjamin/Cummings, Menlo Park, Calif.
3. *IEEE Trans. Software Engineering* (special issue on artificial intelligence and software engineering), J. Mostow, guest ed., Vol. 11, No. 11, Nov. 1985.
4. D.L. Parnas, "Software Aspects of Strategic Defense Systems," *American Scientist*, Nov. 1985.
5. R. Balzer, "A 15-Year Perspective on Automatic Programming," *IEEE Trans. Software Engineering* (special issue on
- artificial intelligence and software engineering), J. Mostow, guest ed., Vol. 11, No. 11, Nov. 1985, pp. 1257-1267.
6. *Computer* (special issue on visual programming), R.B. Grahpton and T. Ichikawa, guest eds., Vol. 18, No. 8, Aug. 1985.
7. G. Raeder, "A Survey of Current Graphical Programming Techniques," *Computer* (special issue on visual programming), R.B. Grahpton and T. Ichikawa, guest eds., Vol. 18, No. 8, Aug. 1985, pp. 11-25.
8. F.P. Brooks, *The Mythical Man-Month*, 1975, Addison-Wesley, Reading, Mass., New York, Chapter 14.
9. Defense Science Board, *Report of the Task Force on Military Software*, in press.
10. H.D. Mills, "Top-Down Programming in Large Systems," in *Debugging Techniques in Large Systems*, R. Ruskin, ed., Prentice-Hall, Englewood Cliffs, N.J., 1971.
11. B.W. Boehm, "A Spiral Model of Software Development and Enhancement," 1985, TRW tech. report 21-371-85, TRW, Inc., 1 Space Park, Redondo Beach, CA 90278.
12. H. Sackman, W.J. Erikson, and E.E. Grant, "Exploratory Experimental Studies Comparing Online and Offline Programming Performance," *CACM*, Vol. 11, No. 1, Jan. 1968, pp. 3-11.



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