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Acknowledgements

References

1. **Binder R. C. and Knapp T. R.** Experimental Determinations of the Flow Characteristics in the Volutes of Centrifugal Pumps. *Trans. ASME, 1936*, **58**, *649–661*

2. **Bowerman R. D. and Acosta A. J.** Effect of the Volute on Performance of a Centrifugal-Pump Impeller. *Trans. ASME, 1957*, **79**(5), *1057–1069*

3. **Iversen H. W., Rolling R. E. and Carlson J. J.** Volute Pressure Distribution, Radial Force on the Impeller, and Volute Mixing Losses of a Radial Flow Centrifugal Pump. *J. of Engineering for Power, Trans. ASME, April 1960*, **82**(2), *136–144*

4. **Csanady G. T.** Radial Forces in a Pump Impeller Caused by Volute Casing, *J. of Engineering for Power, Trans. ASME, October 1962*, **84**(4), *337–340*

5. **Worster R. C.** The Flow in Volutes and its Effect on Centrifugal Pump Performance. *Proceedings of the Inst. of Mechanical Engineers, 1963*, **177**(31), *843–875*

6. **Wesche W.** Designing Pump Volutes with Thick Casing Tongues. *Sulzer Technical Review, 1980*, **4**, *157–161*

7. **Imaichi K., Tsujimoto Y. and Yoshida T.** A Two-Dimensional Analysis of the Interaction Effects of Radial Impeller in Volute Casing. *1980 IAHR-AIRH Symposium, Tokyo, Japan, 635–647*

8. **Kurokawa J.** Theoretical Determinations of the Flow Characteristics in Volutes, *1980 IAHR-AIRH Symposium, Tokyo, 623–634*

9. **Carter D.** A Finite Element Analysis of Ideal Flow in a Centrifugal Pump Volute. *M.S. Thesis, University of Virginia, May 1981*

10. **Flack R. D. and Lanes R. F.** Effects of Volute Geometry and Impeller Orbit on the Hydraulic Performance of a Centrifugal Pump. *Performance Characteristics of Hydraulic Turbines and Pumps, ASME Publication H00280, 1983, 127–133*

11. **Brownell R. B. and Flack R. D.** Flow Characteristics in the Volute and Tongue Region of a Centrifugal Pump. *ASME Paper No. 84-GT-82, 1984*

12. **Eckardt D.** Instantaneous Measurements in the Jet/Wake Discharge Flow of a Centrifugal Compressor Impeller. *J. of Engineering for Power, Trans. ASME, July 1975*, **97**(3), *337–346*

13. **Schodl R.** A Laser-Two Focus (L2F) Velocimeter for Automatic Flow Vector Measurements in the Rotating Components of Turbomachines. *J. of Fluids Engineering, Trans. ASME, December 1980*, **102**(4), *412–419*

14. **Adler D. and Levy Y.** A Laser-Doppler Investigation of the Flow Inside a Backswept, Closed, Centrifugal Impeller. *J. of Mechanical Engineering Science, 1979*, **21**(1), *1–6*

15. **Howard J. H. G., Mukker O. S. and Naoem T.** Laser Doppler Measurements in a Radial Pump Impeller. *Measurement Methods in Rotating Components of Turbomachinery, ASME Publication I00130, 1980, 113–138*

16. **Kannemanns H.** Radial Pump Impeller Measurements Using a Laser Doppler Velocimeter. *ASME Paper No. 80-GT-94, 1980*

17. **Fister W., Zahn G. and Tasche J.** Theoretical and Experimental Investigations About Vaneless Return Channels of Multi-Stage Radial Flow Turbomachines. *ASME Paper No. 82-GT-209, 1982*

18. **Krain H.** A Study on Centrifugal Impeller and Diffuser Flow. *J. of Engineering for Power, Trans. ASME, October 1981*, **103**(4), *688–697*

19. **Kostrzewsky G. J.** Design, Construction and Testing of a Laser Velocimeter for Use with a Plexiglas Centrifugal Pump. *M.S. Thesis, University of Virginia, August 1982*

20. **Hah C.** A Navier Stokes Analysis of Three-Dimensional Turbulent Flows Inside Turbine Blade Rows at Design and Off-Design Conditions. *J. of Engineering for Gas Turbines and Power, Trans. ASME. April 1984*, **106**(2), *421–429*

21. **Rhie C. M., Delaney R. A. and McKain T. F.** Three Dimensional Viscous Flow Analysis for Centrifugal Impellers. *AIAA Paper No. 84-1296, 1984*

Potential Flows: Computer Graphic Solutions

Robert H. Kirchhoff

This admirable little book contains accurate plots of streamlines and velocity contours for 70 potential flows, 8 axisymmetric and the rest two-dimensional. It begins with a simple outline of potential flow theory, in terms of the stream function, velocity potential and complex potential, and the solutions for each flow are outlined in enough detail for a student to be able to fill in the gaps without difficulty. A few sample computer programs are given at the end.

Most lecturers in fluid dynamics will want to recommend this book to their students (the rest will merely crib it for their lecture notes). The style is so clear that it could be used as a teach-yourself book for specialists such as meterologists who have only a peripheral interest in potential flow: it can be warmly recommended to broaden the minds of mathematical students of potential theory.

The programs are directly usable only with a Hewlett Packard desk computer and plotter: one hopes that computer graphics protocols will become more standardized by the time the second edition appears, but if the book achieves the popularity it deserves this will not be long.

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