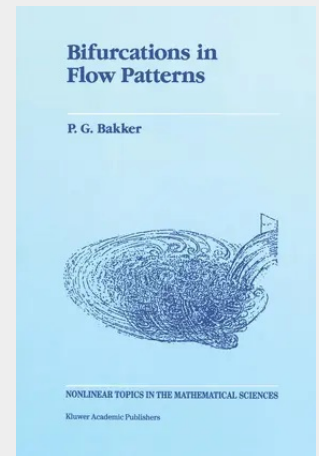


Bifurcations in Flow Patterns

Some Applications of the Qualitative Theory of Differential Equations in Fluid Dynamics

The main idea of the present study is to demonstrate that the qualitative theory of differential equations, when applied to problems in fluid-and gasdynamics, will contribute to the understanding of qualitative aspects of fluid flows, in particular those concerned with geometrical properties of flow fields such as shape and stability of its streamline patterns. It is obvious that insight into the qualitative structure of flow fields is of great importance and appears as an ultimate aim of flow research. Qualitative insight fashions our knowledge and serves as a good guide for further quantitative investigations. Moreover, qualitative information can become very useful, especially when it is applied in close correspondence with numerical methods, in order to interpret and value numerical results. A qualitative analysis may be crucial for the investigation of the flow in the neighbourhood of singularities where a numerical method is not reliable anymore due to discretisation errors being unacceptable. Up till now, familiar research methods -frequently based on rigorous analyses, careful numerical procedures and sophisticated experimental techniques -have increased considerably our qualitative knowledge of flows, albeit that the information is often obtained indirectly by a process of a careful but cumbersome examination of quantitative data. In the past decade, new methods are under development that yield the qualitative information more directly. These methods, make use of the knowledge available in the qualitative theory of differential equations and in the theory of bifurcations.

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160,49 €

149,99 € (zzgl. MwSt.)

Lieferfrist: bis zu 10 Tage

Artikelnummer: 9780792314288

Medium: Buch

ISBN: 978-0-7923-1428-8

Verlag: Springer Netherlands

Erscheinungstermin: 31.10.1991

Sprache(n): Englisch

Auflage: 1991

Serie: Nonlinear Topics in the Mathematical Sciences

Produktform: Gebunden

Gewicht: 1100 g

Seiten: 211

Format (B x H): 160 x 241 mm

