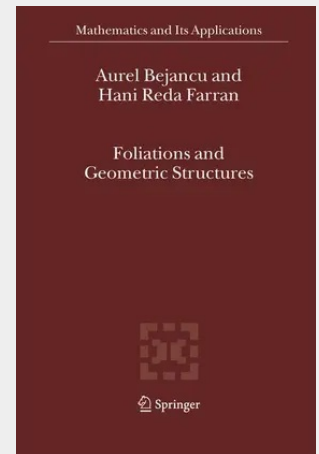


Foliations and Geometric Structures

The theory of foliations of manifolds was created in the forties of the last century by Ch. Ehresmann and G. Reeb [ER44]. Since then, the subject has enjoyed a rapid development and thousands of papers investigating foliations have appeared. A list of papers and preprints on foliations up to 1995 can be found in Tondeur [Ton97]. Due to the great interest of topologists and geometers in this rapidly evolving theory, many books on foliations have also been published one after the other. We mention, for example, the books written by: I. Tamura [Tam76], G. Hector and U. Hirsch [HH83], B. Reinhart [Rei83], C. Camacho and A.L. Neto [CN85], H. Kitahara [Kit86], P. Molino [Mol88], Ph. Tondeur [Ton88], [Ton97], V. Rovenskii [Rov98], A. Candel and L. Conlon [CC03]. Also, the survey written by H.B. Lawson, Jr. [Law74] had a great impact on the development of the theory of foliations. So it is natural to ask: why write yet another book on foliations? The answer is very simple. Our areas of interest and investigation are different. The main theme of this book is to investigate the interrelations between foliations of a manifold on one hand, and the many geometric structures that the manifold may admit on the other hand. Among these structures we mention: affine, Riemannian, semi-Riemannian, Finsler, symplectic, complex and contact structures. Using these structures, the book presents interesting classes of foliations whose geometry is very rich and promising. These include the classes of: Riemannian, totally geodesic, totally umbilical, minimal, parallel non-degenerate, parallel totally - null, parallel partially - null, symmetric, transversally symmetric, Lagrange, totally real and Legendre foliations. Some of these classes appear for the first time in the literature in a book form. Finally, the vertical foliation of a vector bundle is used to develop a gauge theory on the total space of a vector bundle. The book will be of interest to graduate students who want to be introduced to the geometry of foliations, to researchers working on foliations and geometric structures, and to physicists interested in gauge theories.

The book is self-contained. It starts with the basic material on distributions and foliations. Then it proceeds to gradually introduce and build the tools needed for studying the geometry of foliated manifolds. The main theme of the book is to investigate the interrelations between foliations of a manifold on one hand, and the many geometric structures that the manifold may admit on the other hand. Among these structures we mention: affine, Riemannian, semi-Riemannian, Finsler, symplectic, complex and contact structures. Using these structures, the book presents interesting classes of foliations whose geometry is very rich and promising. These include the classes of: Riemannian, totally geodesic, totally umbilical, minimal, parallel non-degenerate, parallel totally - null, parallel partially - null, symmetric, transversally symmetric, Lagrange, totally real and Legendre foliations. Some of these classes appear for the first time in the literature in a book form. Finally, the vertical foliation of a vector bundle is used to develop a gauge theory on the total space of a vector bundle. The book will be of interest to graduate students who want to be introduced to the geometry of foliations, to researchers working on foliations and geometric structures, and to physicists interested in gauge theories.



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