From Editors

Differential geometry is proving to be an increasingly powerful tool that improves its ties to other branches of mathematics such as analysis, topology, algebra, PDEs, and so on, as well as to theoretical physics research.

The growing number of publications in the field of submanifolds was probably the main reason to organize the "International Workshop on Theory of Submanifolds", which took place at Istanbul Technical University, Turkey, from June 2 to June 4, 2016. One of the main features of the conference is the originality of its topic, being the only one focussing particularly on submanifold theory in the last few years. This is remarkable since submanifold theory is a very broad and omnipresent topic, going from surface theory in three-space, with applications in engineering and computer vision for example, to very abstract settings with high dimension and codimension, some of them appearing in modern physical theories.

This volume, containing the proceedings of the above mentioned workshop, provides very recent results mainly on the theory of submanifolds, which the reader would be interested in getting acquainted with.

The book is divided into three parts, each of them having a distinct editor. The first part contains surveys on submanifolds with certain properties, in particular on surfaces. Part two is the biggest one, and is devoted to the theory of submanifolds. The last part extends the main subject of the workshop toward some related topics, such as some geometrical structures which are extended from a manifold to the whole space containing the manifold (e.g. the total space of its cotangent bundle).

The experience of the contributors to the Proceedings is illustrated by their publications in this field and the freshness of this conference was given mainly by the presence of many young mathematicians. The workshop was very successful, despite the critical period of this conference, where many participants had to cancel their participation for reasons beyond their control.

All articles included here passed the usual referee process.

Our warm thanks go to all those who contributed to this book by their work, to all participants of the workshop, to the referees of the Proceedings, to the host institution for organizing the conference and last but not least to our sponsors.

Editors: N. C.Turgay, E. Ö. Canfes, J. Van der Veken , C-L. Bejan
September, 2017

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Foreword

The theory of submanifolds was studied since the invention of calculus and it was started with differential geometry of plane curves. Since then the theory of submanifolds has been developed as an important part of pure and applied mathematics. In recent times, submanifold theory also plays some important roles in computer design, image processing, economic modeling, arts and vision, mathematical physics, relativity theory and cosmology as well as in mathematical biology.

There are two aspects of geometry of submanifolds, namely, intrinsic geometry and extrinsic geometry of submanifolds. Intrinsic differential geometry of submanifolds describes the geometry inside the submanifolds. Extrinsic geometry of submanifolds deals with the shape of submanifolds as subsets of the ambient space.

An important result connecting intrinsic and extrinsic geometry of submanifolds is the 1956 J. F. Nash embedding theorem which states that every Riemannian manifold can be isometrically embedded in a Euclidean space with sufficient high codimension. One important fundamental problem connecting intrinsic geometry and extrinsic geometry of submanifolds is to establish simple optimal relations between the main intrinsic invariants and the main extrinsic invariants of submanifolds as well as to discover their applications.

Since the pioneering work of P. Fermat, L. Euler, G. Monge, and others done in the seventeenth and eighteenth centuries, submanifold theory is still a very active vast research field in pure and applied mathematics. It plays a very important role in the development of modern differential geometry. This branch of mathematics is so far from being exhausted; in fact, only a small portion of an exceedingly fruitful field has been cultivated, much more remains to be discovered in this and coming centuries.

This new series of the Proceedings Book International Workshop on Theory of Submanifolds is a very welcome addition to the literature on the theory of submanifolds. The first volume of this series contains important contribution to the field of submanifold theory. It includes many nice articles on the following contemporary important research topics; submanifolds with parallel mean curvature, biharmonic and biconservative submanifolds, theory of finite type submanifolds, rotational hypersurfaces, curve and surface theory, and quasi-Einstein manifolds.

I expect this new series of Proceedings Book International Workshop on Theory of Submanifolds to play an important role in the future development of geometry of submanifolds for many coming years.

Bang-Yen Chen
April 15, 2017

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