

# Singular Riemannian Foliations with Sections \*

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November 2003

## Abstract

A singular foliation on a complete riemannian manifold is said to be riemannian if every geodesic that is perpendicular at one point to a leaf remains perpendicular to every leaf it meets. In this paper we study singular riemannian foliations that have sections, i.e., totally geodesic complete immersed submanifolds that meet each leaf orthogonally and whose dimensions are the codimensions of the regular leaves.

We prove here that the restriction of the foliation to a slice of a leaf is diffeomorphic to an isoparametric foliation on an open set of an euclidian space. This result gives us local information about the singular foliation and in particular about the singular stratification of the foliation. It also allows us to describe the plaques of the foliation as level sets of a transnormal map (a generalisation of an isoparametric map). We also prove that the regular leaves of a singular riemannian foliation with sections are locally equifocal. We use this property to define a singular holonomy. Then we establish some results about this singular holonomy and illustrate them with a couple of examples.

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\*2000 Mathematics Subject Classifications. 53C12, 57R30

Key words and phrases. Singular riemannian foliations, isoparametric maps, equifocal submanifolds, isoparametric submanifolds, singular holonomy.

<sup>†</sup>Supported by CNPq

# Riemannian Foliations Progress In Mathematics S

**Jürgen Jost**



## Riemannian Foliations Progreb In Mathematics S:

**Riemannian Foliations** Molino, 2012-12-06 Foliation theory has its origins in the global analysis of solutions of ordinary differential equations on an  $n$  dimensional manifold  $M$  an autonomous differential equation is defined by a vector field  $X$  if this vector field has no singularities then its trajectories form a partition of  $M$  into curves i.e a foliation of codimension  $n-1$  More generally a foliation  $F$  of codimension  $q$  on  $M$  corresponds to a partition of  $M$  into immersed submanifolds the leaves of dimension  $p = n - q$  The first global image that comes to mind is that of a stack of plaques Viewed laterally transversally the leaves of such a stacking are the points of a quotient manifold  $W$  of dimension  $q$   $W \subset M$  Actually this image corresponds to an elementary type of foliation that one says is simple For an arbitrary foliation it is only locally on a simple open set  $U$  that the foliation appears as a stack of plaques and admits a local quotient manifold Globally a leaf  $L$  may return and cut a simple open set  $U$  in several plaques sometimes even an infinite number of plaques Riemannian

Foliations Pierre Molino, 1988 *On Minimal Riemannian Foliations* P. G. Walczak, 1981 **Geometric and Dynamical Properties of Riemannian Foliations** Hobum Kim, 1990 Given a Riemannian foliation  $\mathcal{F}$  on a Riemannian manifold  $M$  with a bundle like metric geometric and dynamical properties of geodesics orthogonal to the leaves of the foliation are studied In one line of work the concepts of  $\mathcal{F}$  Jacobi fields and  $\mathcal{F}$  Jacobi tensors are introduced Using these concepts an upper bound for the index of a focal point of a leaf is obtained when the orthogonal complement of the foliation is involutive In particular it is proved that there is no focal point of a leaf of a Riemannian foliation of codimension one Moreover it is also proved that if  $M$  is a complete Riemannian manifold of nonnegative sectional curvature and if the norm of the integrability tensor is small compared with the sectional curvature of  $M$  then  $\mathcal{F}$  is totally geodesic In another line of work it is proved that  $\mathcal{F}$  is harmonic if and only if the geodesic flow preserves the corresponding Riemannian volume form on the normal bundle corresponding to a Sasaki type metric in case  $\mathcal{F}$  is transversally flat 2 There is no Riemannian foliation on a compact Riemannian manifold of negative sectional curvature The proof uses Oseledec's multiplicative ergodic theorem

**Foliations** Alberto Candel, Lawrence Conlon, 2000 Proofs of Conjectures about Singular Riemannian Foliations Marcos M. Alexandrino, 2005 **On the Sobolev Inequality for Riemannian Foliations** Zhiqiang Sun, 2018 *Singular Riemannian Foliations with Sections, Transnormal Maps and Basic Forms* Marcos Martins Alexandrino, Cláudio Gorodski, 2006 *Rigidity Theorems for Riemannian Foliations of Spheres and Lie Groups* Dimitris George Pispinis, 1993

*Contributions to the Theory of Riemann Surfaces* Lars Valerian Ahlfors, E. Calabi, Marston Morse, Leo Sario, Donald Clayton Spencer, 1953-08-21 The description for this book Contributions to the Theory of Riemann Surfaces AM 30 Volume 30 will be forthcoming *Foliations on Riemannian ...* Rovenskii, 1998 A Stability Theorem for Foliations with Singularities A. Piatkowski, 1984 **Bernhard Riemann — On the Hypotheses Which Lie at the Bases of Geometry** Jürgen Jost, 2025-10-02 This book presents William Clifford's English translation of Bernhard Riemann's seminal text accompanied

by detailed mathematical historical and philosophical commentary It explores Riemann's revolutionary ideas on space placing them within the broader framework developed by later thinkers such as Helmholtz Ricci Weyl and Einstein A historical introduction situates Riemann's work in its 19th century context while subsequent chapters trace the evolution of the concept of space across philosophy physics and mathematics and examine its enduring influence up to modern research The second edition includes expanded mathematical commentary a new section on metric geometry and machine learning a systematic bibliography and numerous updates throughout Appealing to mathematicians historians and readers with an interest in physics or philosophy this book provides a comprehensive perspective on Riemann's groundbreaking contributions and their lasting impact

**Riemannian Geometry and Holonomy Groups** Simon Salamon, 1989 Advances in the

Theory of Riemann Surfaces Lars Valerian Ahlfors, 1971-07-21 Intended for researchers in Riemann surfaces this volume summarizes a significant portion of the work done in the field during the years 1966 to 1971

*Symmetric and Alternating Groups as Monodromy Groups of Riemann Surfaces I: Generic Covers and Covers with Many Branch Points* Robert M. Guralnick, John Shareshian, 2007 Considers indecomposable degree  $n$  covers of Riemann surfaces with monodromy group an alternating or symmetric group of degree  $d$  The authors show that if the cover has five or more branch points then the genus grows rapidly with  $n$  unless either  $d \mid n$  or the curves have genus zero there are precisely five branch points and  $n \leq d + 1$

**Singular riemannian foliations with sections and transnormal maps**, 2002 Um resultado clássico da teoria de grupos de Lie garante que as órbitas de uma ação adjunta de um grupo de Lie compacto interceptam um toro máximo ortogonalmente Esta é um exemplo das chamadas ações polares As ações polares são ações de grupos compactos de isometrias que admitem seções subvariedades totalmente geodésicas que interceptam as órbitas ortogonalmente As ações polares e subvariedades isoparamétricas são casos particulares das chamadas folheações riemannianas singulares com este assunto que estudado nesta tese Além de apresentarmos resultados sobre essas folheações singulares apresentamos também resultados sobre as chamadas aplicações transnormais generalizações das aplicações isoparamétricas destacando como estes objetos estão relacionados

Riemannian Geometry Luther Pfahler Eisenhart, 1925 *One-dimensional Riemannian Foliations on the Heisenberg*

*Group* Marius Ionuț Munteanu, 2002 **Riemannian Geometry** L.P. Eisenhart, 1949

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