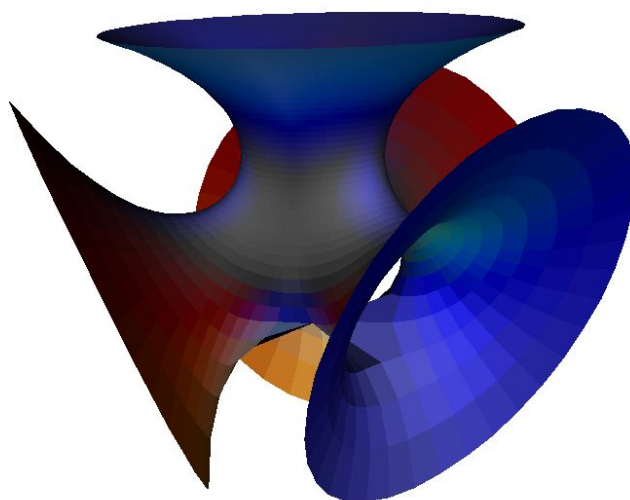


The Third International Workshop on Differential Geometry



Graduate School of Science and Engineering
Saga University
Saga 840-8502, Japan

January 17-18, 2011

The Third International Workshop on Differential Geometry

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Supported by Grant-in-Aid for Scientific Research from JSPS
and Fund of the International Partnership Program of Saga University

A list of invited speakers

Chen Qun (Wuhan University)
Ding Qing (Fudan University)
Fujimori Shoichi (Okayama University)
Kawakami Yu (Kyushu University)
Koiso Miyuki (Kyushu University and PRESTO, JST)
Li Guanghan (Hubei University)
Li Haizhong (Tsinghua University)
Maeda Sadahiro (Saga University)
Qi Xuerong (Saga University)
Wei Guoxin (South China Normal University)
Zhang Weiping (Nankai University)

Organizing Committee

Chen Qun (Wuhan University)
Cheng Qing-Ming (Saga University)
Li Haizhong (Tsinghua University)

Program

January 17, Monday

- 9:10–9:15 Welcome speech by Professor **Hayashida Yukuo**
Dean of Graduate School of Science and Engineering
- 9:15–10:00 **Li Guanghan** (Hubei University)
Mean curvature flow and Bernstein type results of spacelike graphs
- 10:15–11:00 **Koiso Miyuki** (Kyushu University and PRESTO, JST)
Morse index, stability, and bifurcation theory
for variational problems for hypersurfaces with constraint
- 11:15–12:00 **Li Haizhong** (Tsinghua University)
Renormalized volume coefficients $v^{2k}(g)$ and related variational problems

12:00–14:00 **Lunch time**

- 14:00–14:45 **Zhang Weiping** (Nankai University)
Generalized Witten genus and vanishing theorems
- 15:15–16:00 **Qi Xuerong** (Saga University)
Universal bounds for eigenvalues of the buckling problem of arbitrary order
- 16:15–17:00 **Ding Qing** (Fudan University)
An Isoperimetric Inequality for Eigenvalues of the Bi-Harmonic Operator

January 18, Tuesday

9:15–10:00 **Chen Qun** (Wuhan University)

Recent results on Dirac-harmonic maps

10:15–11:00 **Fujimori Shoichi** (Okayama University)

Higher genus mean curvature 1 catenoids in hyperbolic 3-space

11:15–12:00 **Wei Guoxin** (South China Normal University)

Rotational hypersurfaces in Euclidean spaces and spheres

12:00–14:00 **Lunch time**

14:00–14:45 **Maeda Sadahiro** (Saga University)

A certain two-parameters family of helices of order 6 in Euclidean sphere

15:15–16:00 **Kawakami Yu** (Kyushu University)

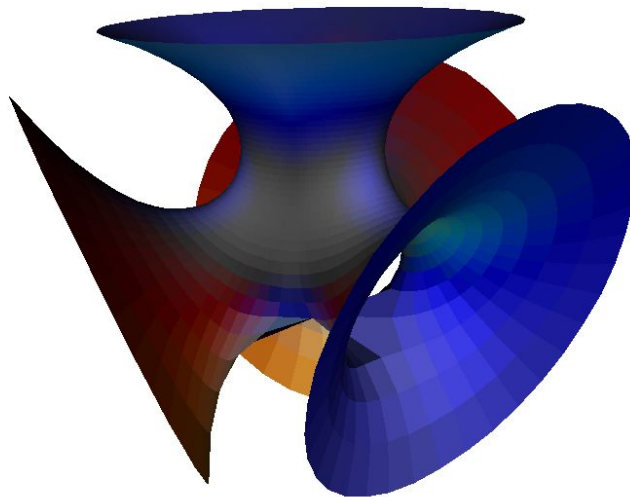
Value distribution of the Gauss map of wave fronts and its application

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Abstracts



Recent results on Dirac-harmonic maps

Chen Qun (Wuhan University)
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Abstract: In this talk, we will introduce some recent results (joint with J.Jost, G.F.Wang and M.M.Zhu respectively) on the boundary value problems of Dirac-harmonic maps.

An Isoperimetric Inequality for Eigenvalues of the Bi-Harmonic Operator

Ding Qing (Fudan University)
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Abstract: In this report, we put forward the Neumann eigenvalue problem for the bi-harmonic operator Δ^2 on a bounded domain Ω in the Euclidean n -space \mathbf{R}^n ($n \geq 2$) and then prove that the corresponding first non-zero eigenvalue $\Upsilon_1(\Omega)$ in the case $n \neq 3$ admits the isoperimetric inequality of Szegő-Weinberger type: $\Upsilon_1(\Omega) \leq \Upsilon_1(B_\Omega)$, where B_Ω is a ball in \mathbf{R}^n with the same volume of Ω . The isoperimetric inequality of Szegő-Weinberger type for the Neumann eigenvalues of the even-multi-Laplacian operators Δ^{2m} on a bounded domain Ω in \mathbf{R}^n is also discussed.

Higher genus mean curvature 1 catenoids in hyperbolic 3-space

Fujimori Shoichi (Okayama University)
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Abstract: We present numerical evidence of the existence of complete constant mean curvature 1 surfaces in hyperbolic 3-space with two embedded ends and any positive genus up to genus twenty.

Value distribution of the Gauss map of wave fronts and its application

Kawakami Yu (Kyushu University)
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Abstract: We give the sharp estimate for the number of exceptional values of the Gauss map of weakly complete flat fronts in hyperbolic three-space. As an application of this result, we provide a new proof of Bernstein type theorem for flat surfaces in hyperbolic three-space. This talk is based on a joint work with Daisuke Nakajo (Kyushu university)

Morse index, stability, and bifurcation theory for variational problems for hypersurfaces with constraint

Koiso Miyuki
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Abstract: In the study of geometric variational problems, it is natural to ask whether each critical point is stable (that is, the considered critical point attains a local minimum of the energy) or not. Also it is important to determine the geometric properties of solutions and to study the structure of the set of solutions. In this talk, as one of the steps to investigate these problems, we discuss stability, existence of bifurcation, and symmetry-breaking for solutions of variational problems for hypersurfaces with constraint. Although our method is sufficiently general to apply various variational problems, we mainly concentrate on hypersurfaces with constant anisotropic mean curvature in the euclidean space, which are characterized as critical points of anisotropic surface energy with volume constraint. Useful criteria for the stability and existence of bifurcation are given by the properties of eigenvalues and eigenfunctions of the eigenvalue problem associated with the second variation of the energy. We will give general methods and their applications to several concrete examples which may be interesting from both mathematical and physical point of view.

Mean curvature flow and Bernstein type results of spacelike graphs

Li Guanghan (Hubei University)
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Abstract: In this talk, I shall discuss the mean curvature flow of spacelike graphs in curved pseudo-Riemannian manifolds. When the ambient space is a pseudo-Riemannian product of two Riemannian manifolds whose curvature tensors satisfy some conditions, I shall prove that the mean curvature flow remains a spacelike graph and exists for all time, if the initial spacelike graph is compact. If the first Riemannian manifold in the product has positive Ricci curvature everywhere, the mean curvature flow converges to a unique slice. Since the submanifold of mean curvature zero is the stable solution of mean curvature flow, I shall give several Bernstein type results for spacelike graph submanifolds immersed in curved pseudo-Riemannian manifolds.

Renormalized volume coefficients $v^{2k}(g)$ and related variational problems

Li Haizhong (Tsinghua University)
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Abstract: The renormalized volume coefficients $v^{2k}(g)$ were introduced and studied by C. Fefferman, C. R. Graham, S.-Y. A. Chang- H. Fang and many others. In this talk, we present our recent works (joint with Zhengchao Han and Bin Guo), which include the variational formulas of the functional $\int_M v^{2k}(g) dv_g$ and their applications, and Kazdan-Warner type identity involving $v^{2k}(g)$. When (M, g) is locally conformally flat, $v^{2k}(g)$ is equal to k -th elementary symmetric function $\sigma_k(g)$ of the eigenvalue of the Schouten tensor A_g . In this case, our results reduce to known results.

A certain two-parameters family of helices of order 6 in Euclidean sphere

Kim Byung Hak (Kyung Hee University) and Maeda Sadahiro (Saga University)
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Abstract: In this talk, using a well-known isometric embedding of a complex projective plane into a 7-dimensional sphere, we find a nice family of helices of order 6 on Euclidean sphere $S^n(c)$, $n \geq 6$. We take small circles of positive curvature k on an $n(\geq 2)$ -dimensional sphere $S^n(c)$ of constant sectional curvature $c(> 0)$. It is well-known that such small circles are closed curves with length $2\pi/\sqrt{k^2 + c}$. Needless to say, this length is shorter than $2\pi/\sqrt{c}$ which is the length of great circles. Since all circles can be regarded as helices of order 2, it is natural to pose the following

Problem. When $n \geq 3$, for every positive constant ρ , does there exist a closed helix whose length is ρ on $S^n(c)$?

The purpose of this talk is to give the following partial affirmative answer to this problem.

Answer. When $n \geq 6$, for every positive constant ρ , there exists a closed helix of order 6 whose length is ρ on $S^n(c)$.

Universal bounds for eigenvalues of the buckling problem of arbitrary order

Qi Xuerong (Saga University)
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Abstract: Let Ω is a bounded domain with piecewise smooth boundary $\partial\Omega$ in an n -dimensional Euclidean space \mathbf{R}^n or an n -dimensional unit sphere \mathbf{S}^n . In this talk, we will discuss eigenvalues of the buckling problem of arbitrary order:

$$\begin{cases} (-\Delta)^l u = -\Lambda \Delta u, & \text{in } \Omega, \\ u = \frac{\partial u}{\partial \nu} = \cdots = \frac{\partial^{l-1} u}{\partial \nu^{l-1}} = 0, & \text{on } \partial\Omega, \end{cases}$$

where Δ denotes the Laplacian and ν denotes the unit outward normal vector field of $\partial\Omega$. We will give universal bounds for eigenvalues.

Rotational hypersurfaces in Euclidean spaces and spheres

Wei Guoxin (South China Normal University)
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Abstract: In this talk, I'll introduce some elementary properties of rotational hypersurfaces and discuss the construction of certain families of submanifolds, such as hypersurfaces with constant scalar curvature, minimal Lagrangian submanifolds in complex hyperquadrics and so on.

Generalized Witten genus and vanishing theorems

Zhang Weiping (Nankai University)
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Abstract: We report our joint work with Qingtao Chen and Fei Han, where we construct a mod 2 analogue of the Witten genus for $8k + 2$ dimensional spin manifolds, as well as modular characteristic numbers for a class of spin^c manifolds which we call string^c manifolds. When these spin^c manifolds are actually spin, one recovers the original Witten genus on string manifolds. These genera vanish on string and string^c complete intersections respectively in complex projective spaces.