

Presentation

The KUDM-OCAMI Joint Workshop on Surface Theory marks the first collaborative event between the Korea University Department of Mathematics and the Osaka Central Advanced Mathematics Institute (OCAMI) since the signing of their Memorandum of Understanding in February 2024. This partnership was established to strengthen the ties between the two institutes; as a Joint Usage/Research Center in Japan, OCAMI is proud to support workshops and conferences hosted at Korea University.

Born from this agreement, the workshop aims to bring together emerging mathematicians from Korea and Japan to exchange ideas and advance research in the field.

We extend our sincere thanks to all speakers and participants for their contributions to this event. We hope you find the workshop both productive and enjoyable.

Organizing committee

JOSEPH CHO
Handong Global University

KATRIN LESCHKE
University of Leicester

YUTA OGATA
Kyoto Sangyo University

SEONG-DEOG YANG
Korea University

9 (Thurs)	
10:00	<i>Registration</i>
10:30	Jungwoo Moon (Chung-Ang Univ)
11:15	<i>Break</i>
11:30	Eungbeom Yeon (Pusan Nat'l Univ)
12:00	<i>Lunch Break</i>
13:30	Sakuma Takeshita (Tokushima Univ)
14:00	Shogo Shimada (Tokushima Univ)
14:30	<i>Break</i>
15:00	Daehwan Kim (Daegu Univ)
15:45	<i>Break</i>
16:00	Riku Kishida (Inst of Science Tokyo)

Daehwan Kim

Daegu Univ

ASYMPTOTIC BEHAVIOR OF MAXIMAL GRAPHS ON UNBOUNDED DOMAINS

This talk investigates maximal graphs using harmonic mappings. It introduces new examples on unbounded domains constructed via harmonic mappings. Alongside these examples, it reviews previous research on the properties of maximal graphs over compact domains and the asymptotic behavior of those over exterior domains. Finally, we discuss Gauss curvature estimate and asymptotic behavior, showing that the growth is at most linear and at least logarithmic.

Riku Kishida

Institute of Science Tokyo

A NEW FRAMEWORK OF ZERO MEAN CURVATURE SURFACES IN THE ISOTROPIC 3-SPACE

The isotropic 3-space \mathbb{I}^3 is the 3-dimensional real vector space with the degenerate inner product of signature $(0 + +)$. For a space-like surface in \mathbb{I}^3 , the mean curvature function can be defined in a natural way. A space-like surface whose mean curvature function vanishes everywhere is called a zero mean curvature surface. A zero mean curvature surface in \mathbb{I}^3 can be regarded, via Weierstrass-type representation formulas, as the intermediate between a minimal surface in the Euclidean 3-space and a maximal surface in the Lorentz-Minkowski 3-space. As in the case of maximal surfaces, there exist many examples of zero mean curvature surfaces in \mathbb{I}^3 with singularities. In this talk, we introduce a class of zero mean curvature surfaces with singularities in \mathbb{I}^3 , which we call ZMC-faces. As an application of ZMC-faces, we show that several Osserman-type inequalities can be obtained under certain assumptions on both completeness and finiteness of the total curvature. We also present some examples which attain the equality in these inequalities.

Jungwoo Moon

Chung-Ang Univ

A COMPACT EINSTEIN TYPE MANIFOLD WITH A RIEMANNIAN FLOW

In this talk, we prove that a Riemannian flow generated by the potential vector field of a compact Einstein-type manifold is necessarily geodesible. As a corollary, we investigate some properties of a compact almost Ricci soliton.

Shogo Shimada

Tokushima Univ

BÄCKLUND TRANSFORMATIONS FOR SURFACES AND CURVES

Transformation theory plays a pivotal role in the study of integrable systems. We focus on Bäcklund transformations for surfaces of constant negative Gaussian curvature (K-surfaces). The Bäcklund transformation constructs new K-surfaces from a given one and, at the same time, generates new solutions to the sine-Gordon equation, which is the structure equation of K-surfaces. Geometric approaches based on such transformations have been actively studied in order to understand various phenomena in integrable systems, including the superposition of solutions to the sine-Gordon equation.

We first review Bäcklund transformations for K-surfaces and derive the corresponding transformation for solutions to the sine-Gordon equation. We then introduce our ongoing joint work with Masashi Yasumoto on Bäcklund transformations for curves of constant torsion. We show that two types of semi-discrete integrable equations arise from these transformations, generalizing those obtained by Calini and Ivey. Finally, we present an approach to applying these ideas to the formulation of semi-discrete K-surfaces.

Sakuma Takeshita

Tokushima Univ

DISCRETE MINIMAL DARBOUX TRANSFORMATIONS

Corro, Ferreira, and Tenenblat illustrated minimal surfaces in the Euclidean space related by Darboux transformations. A pair of minimal surfaces related by Darboux transformations is called a minimal Darboux pair, and a superposition principle for minimal Darboux pairs was further demonstrated. Subsequently, Martínez, Roitman, and Tenenblat showed that the corresponding Gauss maps satisfy a Riccati-type differential equation, and Hertrich-Jeromin and Honda simplified this proof by employing the Bianchi permutability of transformations for isothermic surfaces.

In this talk, using a quaternionic calculus, we introduce the permutability of Christoffel, Goursat, and Darboux transformations for discrete isothermic surfaces in the Euclidean space. As an application, it is shown that the corresponding discrete Gauss maps of a discrete minimal Darboux pair satisfy a Riccati-type difference equation. Furthermore, by applying the higher-dimensional permutability, we obtain a superposition principle for discrete minimal Darboux pairs. This is based on ongoing project with Masashi Yasumoto.

Eungbeom Yeon
Pusan National University

**COMPLETE EMBEDDED MINIMAL SURFACES
OF FINITE TOPOLOGY IN \mathbb{R}^4 AND \mathbb{R}^5**

In 1983, Costa discovered a complete embedded minimal surface in three-dimensional Euclidean space with genus one and three embedded ends. Building on this result, Hoffman and Meeks later constructed complete embedded minimal surfaces with three embedded ends and arbitrary genus. In this talk, we discuss how the Costa–Hoffman–Meeks surfaces can be generalized to four- and five-dimensional Euclidean spaces. We highlight several features of these new examples, including both their similarities to and differences from the Costa–Hoffman–Meeks surfaces in three-dimensional space. This talk is based on joint works with Dr. Jaehoon Lee.