Technical University of Civil Engineering Bucharest
Faculty of Railways, Roads and Bridges

University of Bucharest
Faculty of Mathematics and Computer Science

The International Conference Riemannian Geometry and Applications - Day 3

– RIGA 2021-

Bucharest, Romania, January 17 2021

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§1. Preliminaries

Definition

A Finsler norm, or metric, on a real smooth, n-dimensional manifold M is a function $F : TM \to [0, \infty)$ that is positive and smooth on $\widetilde{TM} = TM \backslash \{0\}$, has the *homogeneity property* $F(x, \lambda v) = \lambda F(x, v)$, for all $\lambda > 0$ and all $v \in T_x M$, having also the *strong convexity* property that the Hessian matrix

$$g_{ij} = \frac{1}{2} \frac{\partial^2 F^2}{\partial y^i \partial y^j}$$

is positive definite at any point $u = (x^i, y^i) \in \widetilde{TM}$.
(M, F) ia called a *Finsler manifold* or *Finsler structure*.

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Some Valuable References

C. Udrişte, *Convex functions and optimization methods in Riemannian manifolds*, Mathematics and Its Applications, Vol. 297, Kluwer Academic, Dordrecht, 1994.

M. M. Postnikov, *Geometry VI: Riemannian geometry*, Springer-Verlag, 2001.

Esa Sharahi (Guest)

Participants

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AC The International Conference...
Very nice talk. Congratulations!

Reply

MT The International Conference...
Nice tlak. Thank you Prof Sharahi

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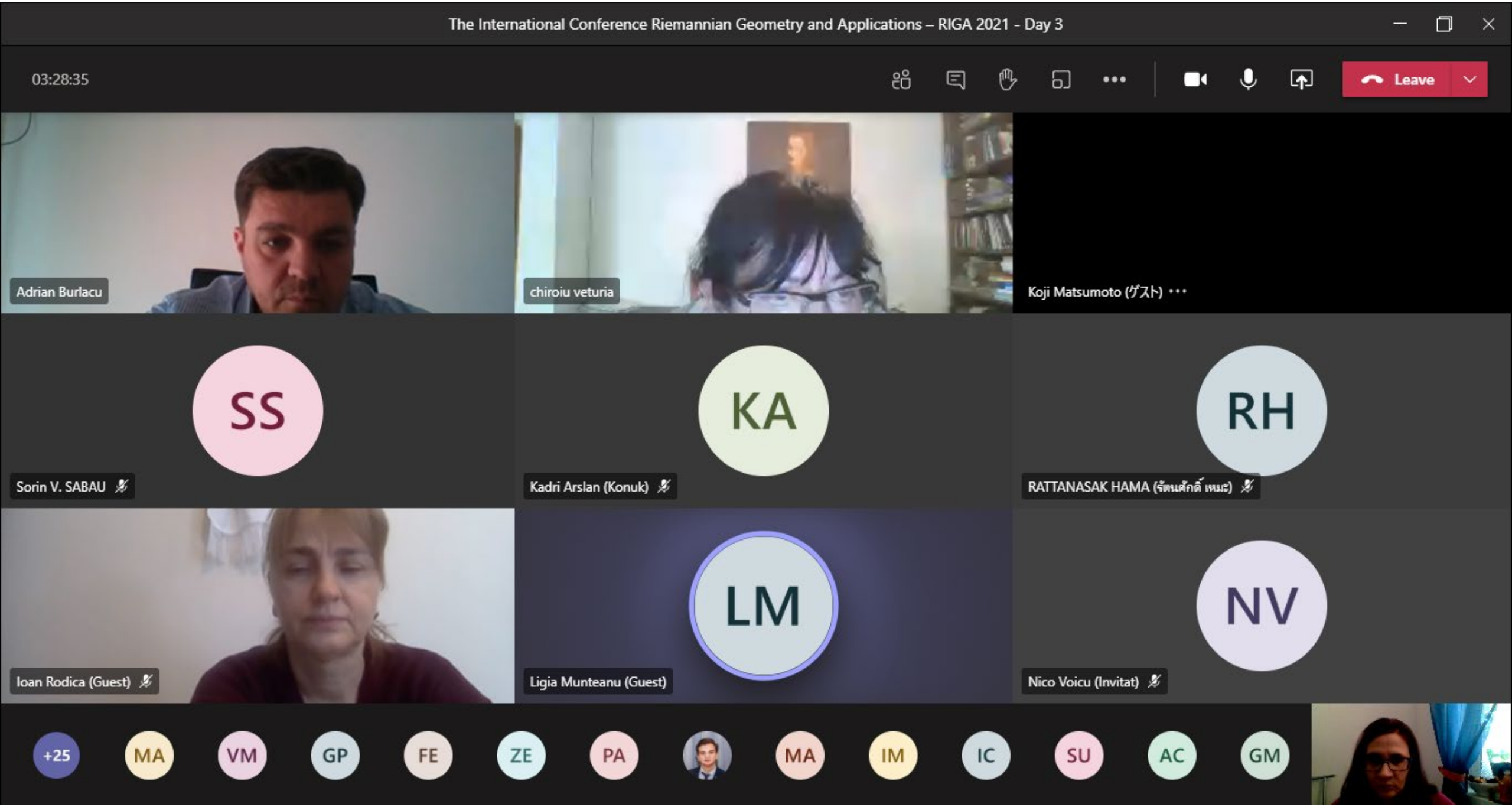
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Consider next, the Liouville–Tzitzeica equation

$$u_{xt} = \exp u\,, \qquad (5)$$

$$v_{xt} = 0\,. \qquad (6)$$

$$u_x + v_x = \sqrt{2}\exp\frac{u-v}{2}\,,\quad u_t - v_t = \sqrt{2}\exp\frac{u+v}{2}\,. \qquad (7)$$

$$\begin{aligned} u_{xt} + v_{xt} &= \frac{1}{\sqrt{2}}(u_t - v_t)\exp\frac{u-v}{2} = \exp u\,, \\ u_{tx} - v_{tx} &= \frac{1}{\sqrt{2}}(u_x + v_x)\exp\frac{u+v}{2} = \exp u\,, \end{aligned} \qquad (8)$$

27

Diapozitiv 27 din 64

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Example 2. Diagonal Hopf manifolds.[5]

One considers $H_A = (\mathbb{C}^n)/\langle A\rangle$ with $A = \mathrm{diag}(\alpha_i)$ endowed with

- Complex structure as the projection of the standard one of $\mathbb{C}^n$.
- l.c.K. structure constructed as follows:
  Let $C > 1$ be a constant and

$$\varphi(z_1, \ldots, z_n) = \sum |z_i|^{\beta_i}, \ \ \beta_i = \log_{|\alpha_i|^{-1}} C$$

a potential on $\mathbb{C}^n$.

Then $A^*\varphi = C^{-1}\varphi$. Thus $\Omega = \sqrt{-1}\partial\overline{\partial}$ is Kähler.
The Lee field $\theta^{\#} = -\sum z_i \log|\alpha_i|\partial z_i$ is parallel.

[5] I. Verbitsky, *Theorems on the vanishing of cohomology for locally conformally hyper-Kähler manifolds*, (Russian) Tr. Mat. Inst. Steklova **246** (2004), Algebr. Geom. Metody, Svyazi i Prilozh., 64–91; translation in Proc. Steklov Inst. Math. 246 (2004), 54–78.

Prove Dualities in Differential Eq. and Dif. Inequalities

($\Longrightarrow$) Now we set $g = \frac{\kappa f'}{f}$. and g is well-defined function in $(0, \tau)$.

It follows from the quotient law, (1), and (4) that

$$g' = \frac{\kappa f'' f - \kappa (f')^2}{f^2}$$

$$= (\text{resp. } \leq, \geq) \frac{-\kappa G f^2}{f^2} - \frac{\left(\frac{\kappa f'}{f}\right)^2}{\kappa}$$

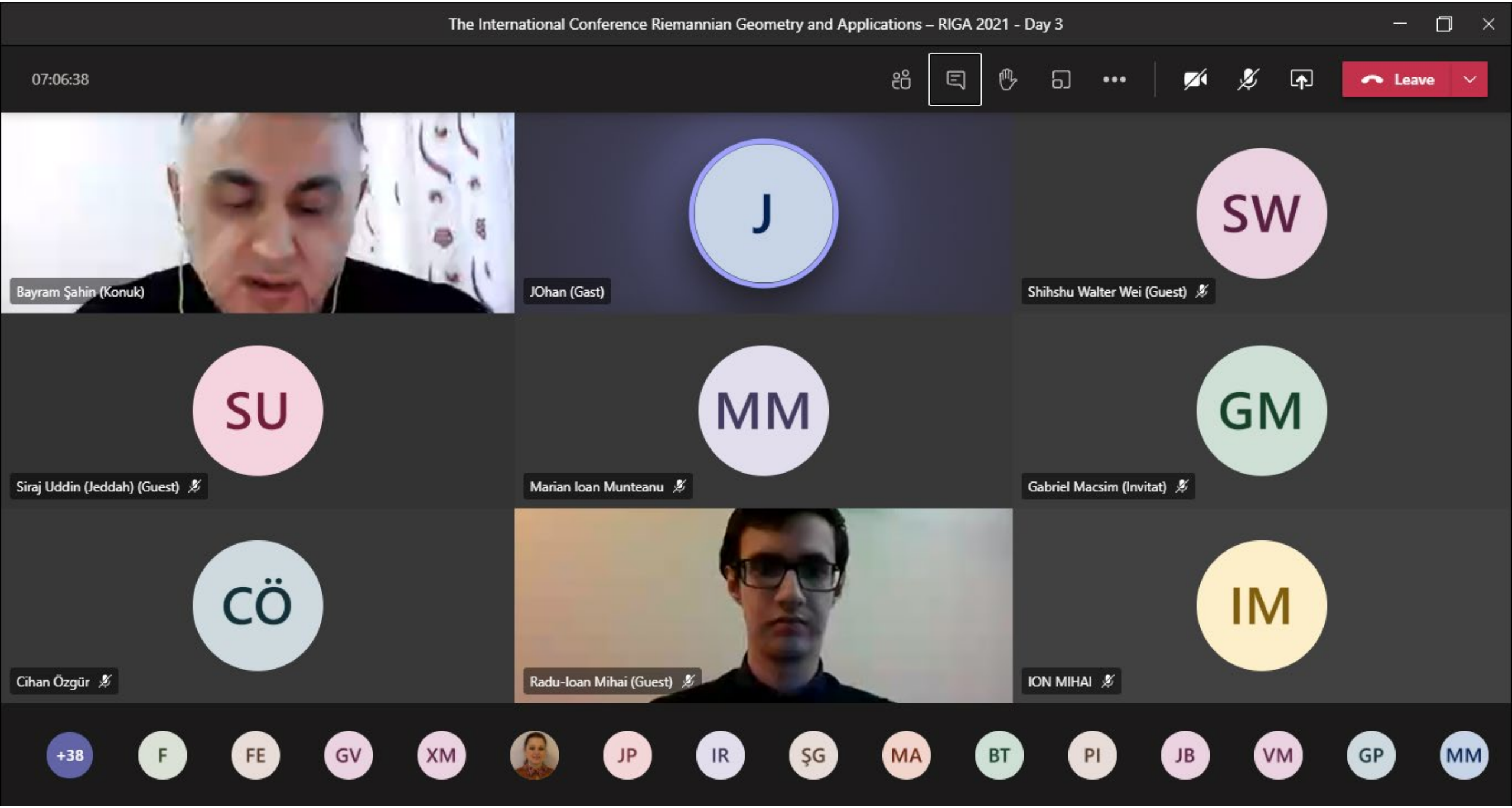
$$= (\text{resp. } \leq, \geq) - \kappa G - \frac{g^2}{\kappa} \quad \text{a. e.} \quad \text{in} \quad (0, \tau).$$

Thus we obtain a first-order nonlinear differential equation

$$g' + \frac{g^2}{\kappa} + \kappa G = 0 \, (\text{resp. } \leq 0 \, , \geq 0)$$

with the initial conditions at 0 converted to the asymptotic one at 0 :

$$g(t) = \kappa \frac{f'(t)}{f(t)} = \kappa \frac{\kappa + O(t)}{\kappa t + O(t^2)} = \frac{\kappa}{t} \cdot \frac{1 + O(t)}{1 + O(t)}$$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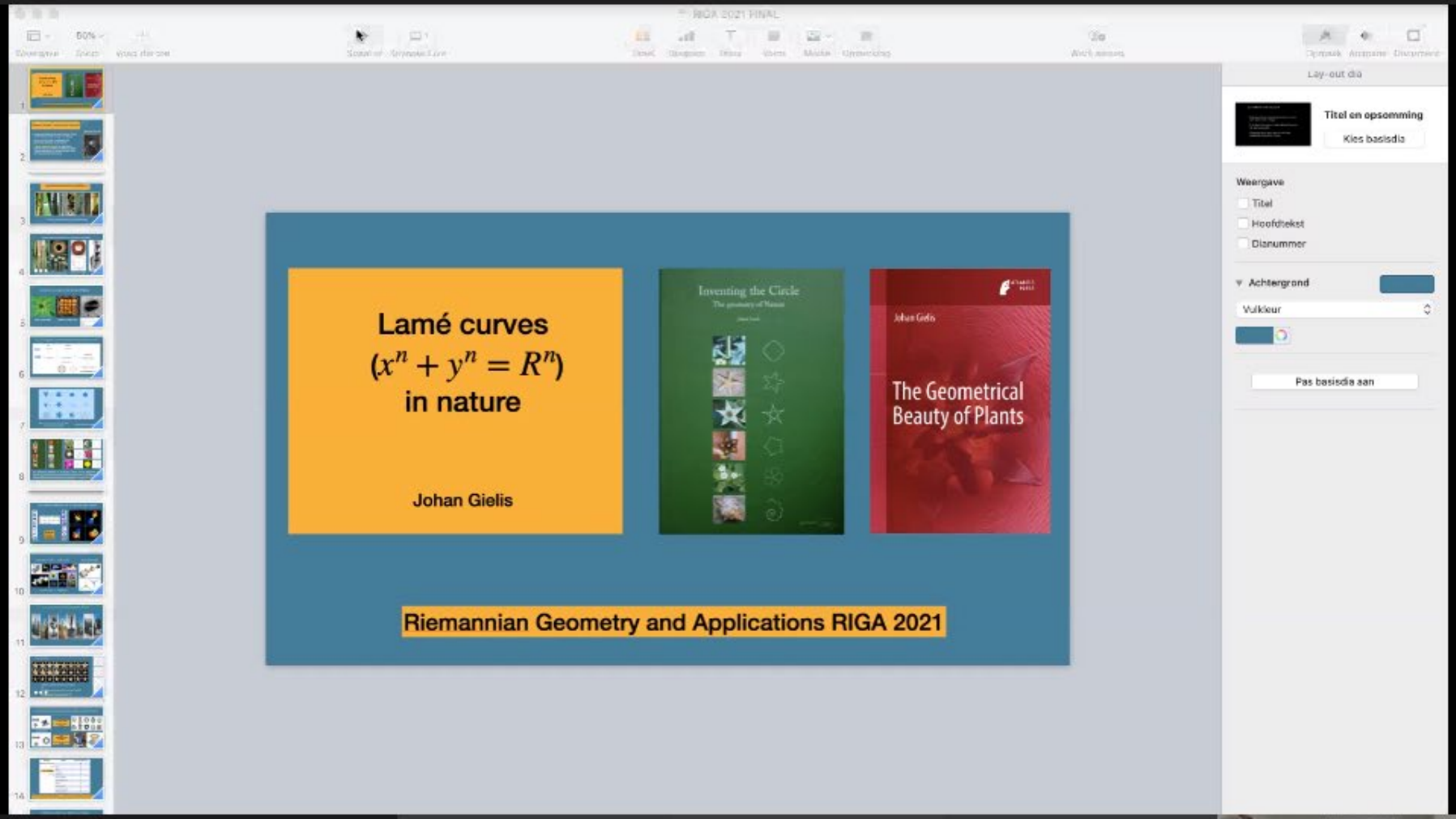

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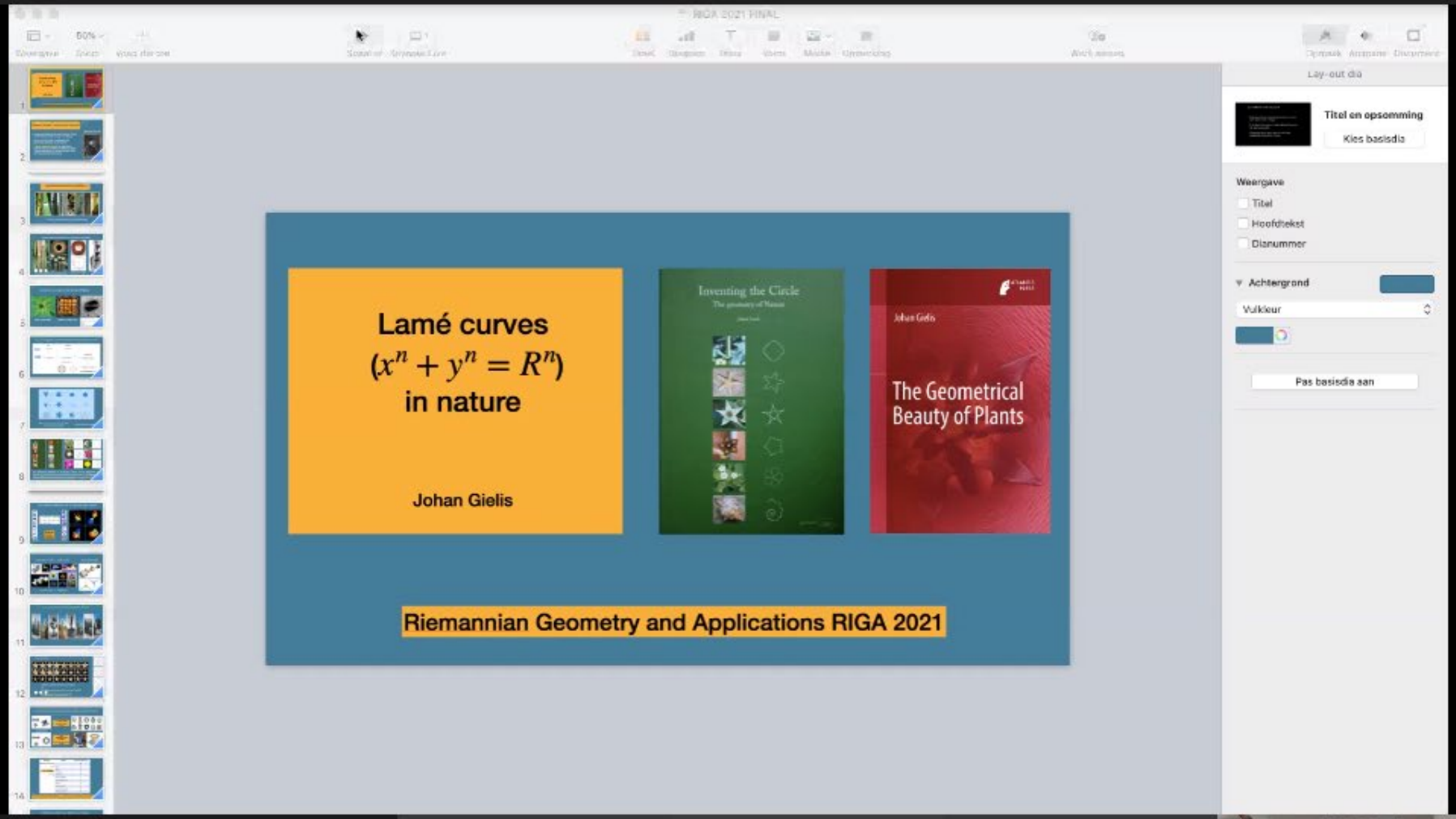

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Comparison Principle, Duality, and Harmonicity - Comparing Diverse Phenomena and Discovering Secret Unity

Shihshu Walter Wei

The University of Oklahoma

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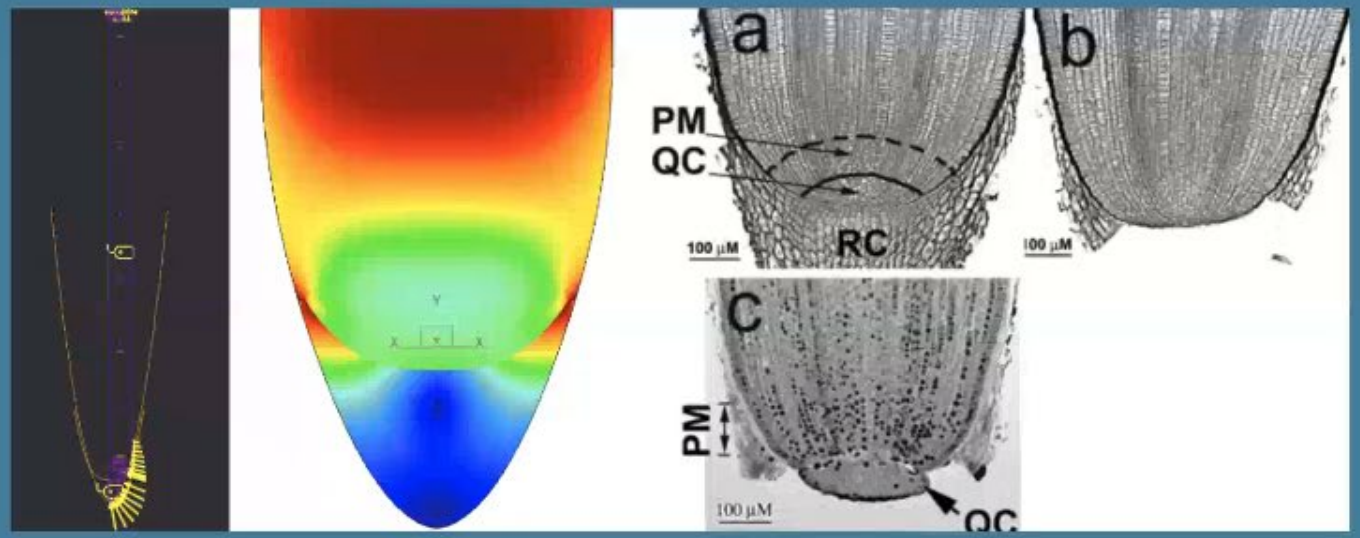
A Geometric Interpretation of Some Relations Between Integer Sequences

Radu-Ioan MIHAI

Student, Faculty of Mathematics and Computer Science

University of Bucharest, Romania

Stress and Strain in roots: a natural metamaterial



The structure of root and root cap, create a quiescent centre at the **Flackpunkt** of the superellipsoids (or superparaboloid)

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Harmonic metrics, harmonic tensors and identity map

Bang-Yen Chen

Michigan State University

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Two fundamental theorems for harmonic metrics

- Let $\mathcal{F}(M)$ = the space of smooth functions on M. The next two theorems describe the space of all harmonic tensors of (M, g).

  Theorem 3. If (M, g) is a Riemannian manifold with $\dim M \geq 3$, then we have the following linear isomorphism:

  $$\{\text{Harmonic metrics of } M\} \cong \{T \in \mathcal{S} : \delta T = 0\} = \{\text{Conservative metrics of } M\}.$$

  This isomorphism is given by $\mathcal{S} \ni g' \mapsto T_{g'} = g' - \frac{1}{2}(\mathrm{tr}_g\, g')g \in \ker(\delta)$.

- **Theorem 4.** If $\dim M = 2$, then

$$\{\text{Harmonic metrics of } (M, g)\} = \{\text{Conservative metrics of } (M, g)\} \oplus \{\lambda g : \lambda \in \mathcal{F}(M)\},$$

  where $\{\lambda g : \lambda \in \mathcal{F}(M)\}$ is the set of all conformal changes of metric g.

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Tadashi Nagano, Kentaro Yano and Katsumi Nomizu

Yano and Nomizu.jpg

Tadashi Nagano (1930–2017) (left),
Kentaro Yano (1912–1993) (center),
Katsumi Nomizu (1924–2008) (right).

Bang-Yen Chen (Guest)

Participants

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Kentaro Yano at Michigan State University

Yano and Chen at East Lansing, Michigan on May 14, 1972.

Bang-Yen Chen (Guest)

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Bayram Şahin (Konuk) JOhan (Gast) BC Bang-Yen Chen (Guest)

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Nagano and Chen in Tokyo, Japan

T. Nagano, B. Y. Chen, Y. Ohnita and Y. Tazawa in Tokyo 1998.

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Change scene

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