

Historical Aspects and Milestones in the Development of Structural Mechanics in Finland

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- ❑ Early history of engineering education in Finland
- ❑ History of structural engineering education
- ❑ Roots of structural mechanics development in Finland
- ❑ Establishment of the Journal of Structural Mechanics
- ❑ Future challenges in structural mechanics development

Early history of engineering education in Finland

- ❑ Technical School of Helsinki was established in 1849
- ❑ The School was upgraded to Polytechnic School in 1872, and to Polytechnic Institute in 1879
- ❑ Renamed the Technological University of Finland in 1908
- ❑ Education since 1858
 - Chemical technology (↪ wood processing)
 - Mechanical Engineering (↪ electrical and radio engineering)
 - Architecture
 - Surveying
 - "General engineering" (incl. civil engineering)



Building of the Polytechnic School and
the Technical University in 1877 – 1959
Designed by F. A. Sjöström

Early history of structural engineering education

- ❑ Education in the Engineering Department started in 1858
 - Bridge building
 - Water konstruktion
- ❑ First professors in civil engineering
 - Endre Levke / Norway in 1858 (bridge building and water construction)
 - Mikael Strukelin / Slovenia in 1879 (bridge building and water construction)
 - Axel Juselius in 1908 (water construction)
- ❑ Key professors in the structural engieneering development
 - Henrik Probus Ossian Solitander (water construction in 1929/1938 - 1958)
 - Herman Ossian Hannelius (bridge building and building statics in 1924 - 1956)



Henrik Solitander



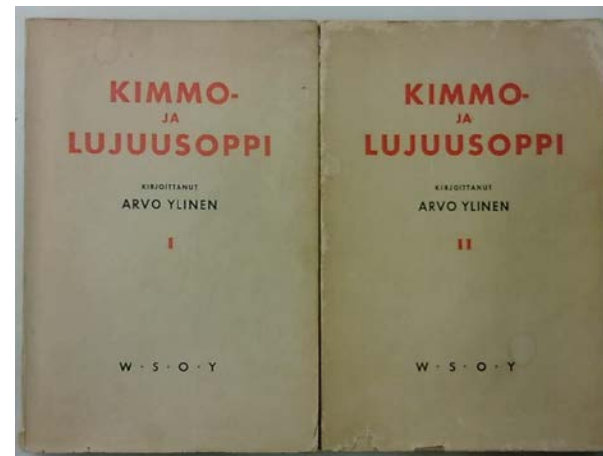
Herman Hannelius

Roots of structural mechanics development in Finland

- ❑ The first "unofficial highschool" in structural mechanics
 - The State Aircraft Factory in 1930 -1960 with engineering staff of 60 members
 - Provided several professors to the Helsinki University of Technology (HUT)
- ❑ Arvo Albin Johannes Ylinen
 - Chief designer and technical director of the Aircraft Factory in 1932 - 1940
 - First doctor in aircraft engineering in Finland, year 1938
 - Professor of aviation technology in 1940 - 1956 and of building statics in 1956 -1967
 - Author of "Kimmo- ja lujuusoppi I - II" in 1950, upgraded in 1965 - 1967
 - Inspired a large group of students to study and develop structural mechanics



Arvo Ylinen



Roots of structural mechanics development in Finland, cont.

- ❑ The second "unofficial highschool" in structural mechanics
 - The Bridge Building Department of the TVH (National Board of Public Roads and Waterways)
 - Responsible for the bridge building development in Finland since 1920s
 - Become "school of thoughts" in structural mechanics in the 1960s
- ❑ Heimo Pellervo Paavola
 - Chief design engineer of the Bridge Department in 1959 -1965
 - Modernised the education of structural mechanics in HUT in 1956 - 1962
 - Invited a group of talented students to work for the Bridge Department
 - Professor in bridge building at HUT in 1970 - 1986
 - Co-founder of the Journal of Structural Mechanics and the Finnish Association for Structural Mechanics

Bridges designed by Heimo Paavola



Hännilänsalmi suspension bridge in 1962



Ahvenkoski longer beam bridge in 1965



Heimo Paavola in 1987

Developments in 1960s and 1970s

❑ Education and research in structural mechanics

- Extended to new areas (plastic & viscoelastic materials, nonlinear systems, structural dynamics, fluid mechanics etc.)
- Increased computational power (FEM and 3D calculations. commercial software)
- Special fields of the development (ice mechanics, structures in arctic conditions)

❑ Establishment of the Journal of Structural Mechanics

- Initiated by Pauli Jumppanen and Heimo Paavola in 1968
- To create publication space for a number new scientific papers
- To strengthen the identity of the structural mechanics community
- To get a vehicle for international co-operation

❑ Establishment of the Finnish Association for Structural Mechanics in 1970

- For co-operation with the industry and other technical universities in Finland

Future challenges in structural mechanics development

❑ New computational mechanics

- Increased computational power \leftrightarrow super/quantum computers?
- Stochastic computational processes (finite elements etc.)
- Novel mathematics (fuzzy systems, game theory, network mathematics)

❑ Artificial intelligence and algorithms

- Expert systems for structural analysis and design
- Multi-disciplinary optimization (MDO) for identification of new combinations of structures, materials, power systems etc.
- New analytical algorithms to enhance rapid integration of new and existing technologies.

❑ Novel innovative structures

- High-rise & landmark buildings and bridges
- Complex architectural achievements
- Structures of advanced, multi-functional materials

A proposal to the Finnish Association for Structural Mechanics

- ❑ Working out the vision for structural mechanics development in Finland for 20-30 years to come
- ❑ Identifying strategic issues in the realization of the vision statement
- ❑ Writing down desired outcomes to be achieved from the strategy implementation
- ❑ Preparing information (a white paper) for promoting and marketing the contributions of structural mechanics to the modern society

Nothing is impossible to the willing mind!
(the Han Dynasty of China)

THANK YOU !



*Finnish expedition to the North Pole
Photo: Markku Lepola*