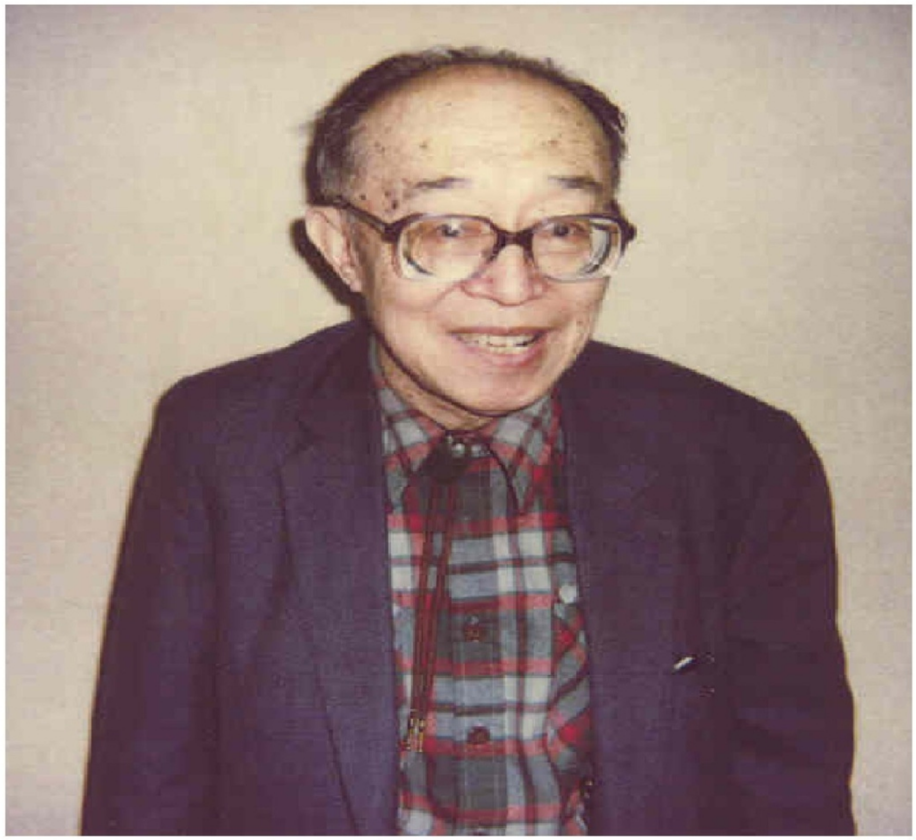
Eighteenth Annual Shih-I Pai Lecture

October 2, 2012



Professor Shih-I Pai

Shih-I Pai

1913 - 1996

Founding member of

IFDAM/IPST

1949-1983

14 books, ~200 articles

He was an expert on the effects of turbulence on lift and drag of airplanes

Shih-I Pai

- 1935, B.S. Electrical Engineering, National Central University, China
- 1938, M.S. Aero. Eng. MIT
- 1940, Ph.D. Aeronautics and Mathematics, Caltech
- 1940-47, Professor, Nat. Cent. Univ., China
- 1947-49, Visiting Professor, Aero. Eng., Cornell
- 1949, Founding Member, IFDAM

  University of Maryland
- 1957, Guggenheim Fellow
- Authored 14 books on different topics in fluid and plasma dynamics, and about 200 research papers.
- 1968, Hon. Doc., T.U., Vienna
- 1983, Professor Emeritus, UMD

Alexander Weinstein

was at IFDAM 1949-1967. Weinstein's research covered a wide range of topics. He is famed for solving a variety of boundary value problems. For example he solved Helmholtz's problem for jets, giving the first uniqueness and existence theorems for free jets in a series of papers from 1923 to 1929. He examined boundary problems in an infinite strip, giving hydrodynamic and electromagnetic applications.

Elliott Montroll

Member of IFDAM 1951-1960
Member of IPST 1980-1983

From Wikipedia,

Elliott Waters Montroll (May 4, 1916 in Pittsburgh, Pennsylvania, USA – December 3, 1983 in Chevy Chase, Maryland, USA) was an American scientist and mathematician.

In 1951 he was appointed Research Professor in IFDAM.

However, in 1960, he took the post of Director of General Sciences at the IBM Thomas J. Watson Research Center in Yorktown Heights, New York...

In 1966 he returned to the academic world as 'Albert Einstein Professor of Physics at the University of Rochester. Later he returned to the University of Maryland.

He was elected to the National Academy of Sciences (United States) in 1969,

Elliot W. Montroll

Elliott Waters Montroll (1916–1983)

Born	May 4, 1916 Pittsburgh, Pennsylvania, USA
Died	December 3, 1983 (aged 67) Chevy Chase, Maryland, USA

Early Montroll

MARKOFF CHAINS AND QUANTUM THEORY 437

A second type of Wiener integral which can be discussed systematically is

$$\int_C^W \exp\left\{-\alpha \int_0^t V[x(\theta)]\, d\theta\right\} d_w x \tag{3.24}$$

where $V(x)$ is a real continuous function of x. This case has been investigated by Kac [17]. As before we let $\theta = jt/n$. We can, without added complication, replace the quantity $(x_j - x_{j-1})^2/(t_j - t_{j-1})$ in the Wiener integrals by the general function $G([x_j - x_{j-1}]/[t_j - t_{j-1}]^{1/2})$ with the property

$$\mu = \int_{-\infty}^{\infty} \exp\{-G(z)\}\, dz, \qquad 0 = \int_{-\infty}^{\infty} z \exp\{-G(z)\}\, dz,$$

(3.25)

$$\mu\gamma^2 = \int_{-\infty}^{\infty} z^2 \exp\{-G(z)\}\, dz,$$

where μ and γ are constants which depend on the form of $G(z)$. With no more effort we can also choose the initial distribution of x_0 to be $p(x_0)$ rather than $\delta(x_0)$ as was assumed in (3.1). The generalization of (3.1) is then

$$\int_C^W \exp\left\{-\alpha \int_0^t V[x(\theta)]\, d\theta\right\} d_w x$$

(3.26a)

Late Montroll

Reprinted from

Proc. Natl. Acad. Sci. USA
Vol. 75, No. 10, pp. 4633–4637, October 1978
Applied Mathematical Sciences

Social dynamics and the quantifying of social forces

(logistic curve/replacement and evolution/transportation)

ELLIOTT W. MONTROLL

Institute for Fundamental Studies, Department of Physics, University of Rochester, Rochester, New York 14627

Contributed by Elliott W. Montroll, July 10, 1978

ABSTRACT Social and industrial evolutionary processes are considered to be a sequence of replacements or substitutions: new ideas for old, new labor patterns for old, new technologies for old. The logistic equation has often been used to describe population growth processes and replacement processes. It sometimes suffers from contradicting observational data. It is shown here that the deviations are often associated with unusual intermittent events—wars, strikes, economic panics, etc.—and that in many cases a few years after the event it can be abstracted as an instantaneous δ function impulse. After the event, the evolutionary process continues along its normal course. A formula is derived to use the observational data to determine the strength of the impulse modeling an event.

During any period of history, the middle-aged and elderly lament upon the changes "in the world" during their lifetime, complaining that "things" are no longer what they were. The things that have changed the most vary from one generation to another. In this century the automobile has replaced the horse; the light bulb, the gas mantle; the movie theatre, home entertainment (finally, television, the movie theatre); the Balkan States of the Soviet Bloc, the old Austro-Hungarian Empire; the meaningful relationship, formal marriage; to name just a few. The continuing change in our habits and loyalties is bound to affect economic and social structures. On this basis, social science models should include the evolution of social processes.

The aim of this paper is to present an elementary point of

(b) In the absence of any social, economic, or ecological force, the rate of change of the logarithm of the price of maintenance $P(t)$ (per unit time) of an "organism" is also constant

$$d\log P(t)/dt = \text{constant}. \tag{1b}$$

In the case of objects of production, $P(t)$ is to be interpreted as a unit cost.

A discussion of part *b* of the first law and of the influence of prices on part *a* will be given elsewhere.

The population of inanimate objects is included so that population growth models might be applied to production of and competition between manufactured items.

Eq. 1a is, of course, nothing but the Malthusian law of exponentiation of populations (2), and Eq. 1b is a statement of the accountants' "discounting" principle and the housewives' observation that things are always getting more expensive. The constant in Eq. 1a might be negative as well as positive because interest in some items just dies away.

It might be claimed that the first law of social dynamics is more often applicable to the real world than is Newton's first law of mechanics to real dynamical systems, since social reformers as well as conservative politicians frequently seek means of violating Eqs. 1a and 1b. Numerous observations exhibiting the first law are in refs. 3 and 4.

Slide from Mike Shlesinger

Johannes (Jan) Martinus Burgers (Arnhem, January 13, 1895 – Washington D.C., June 7, 1981) was a Dutch physicist and the brother of the physicist W. G. Burgers. Burgers studied in Leiden under Paul Ehrenfest, where he obtained his PhD in 1918. He is credited to be the father of Burgers' equation, the Burgers vector in dislocation theory and the Burgers material in viscoelasticity.

Jan Burgers was one of the co-founders of the International Union of Theoretical and Applied Mechanics (IUTAM) in 1946, and was its secretary-general from 1946 until 1952.[1]

Joined IFDAM in 1955- Attracted to Maryland from Delft by the Slawski twins, who were heads of research for the Army and Navy.

J. M. Burgers

Jan Burgers

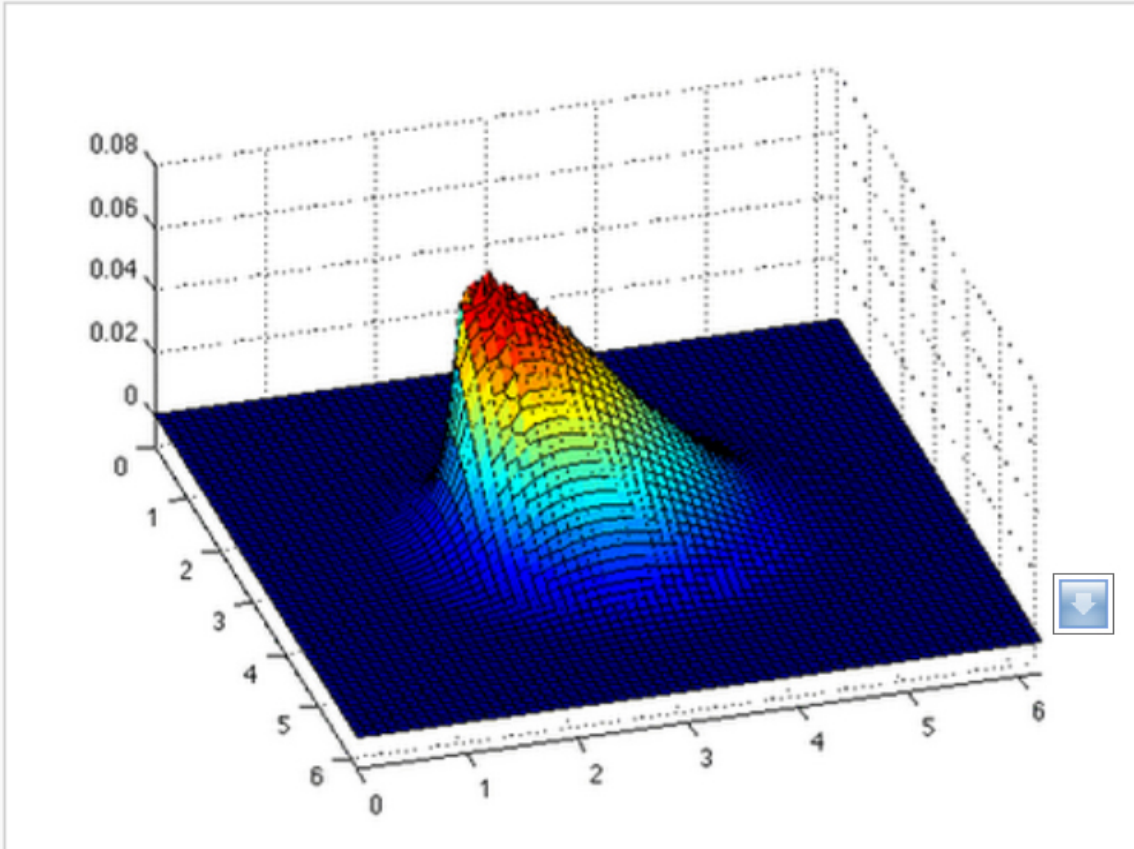
Born	January 13, 1895 Arnhem, Netherlands
Died	June 7, 1981 (aged 86) Washington, USA
Residence	Netherlands United States
Nationality	Dutch
Fields	Physicist

Burgers' Equation

Burgers' equation is a fundamental partial differential equation from fluid mechanics. It occurs in various areas of applied mathematics, such as modeling of gas dynamics and traffic flow. It is named for Johannes Martinus Burgers (1895–1981).

For a given velocity *u* and viscosity coefficient ν, the general form of Burgers' equation (also known as **viscous Burgers' equation**) is:

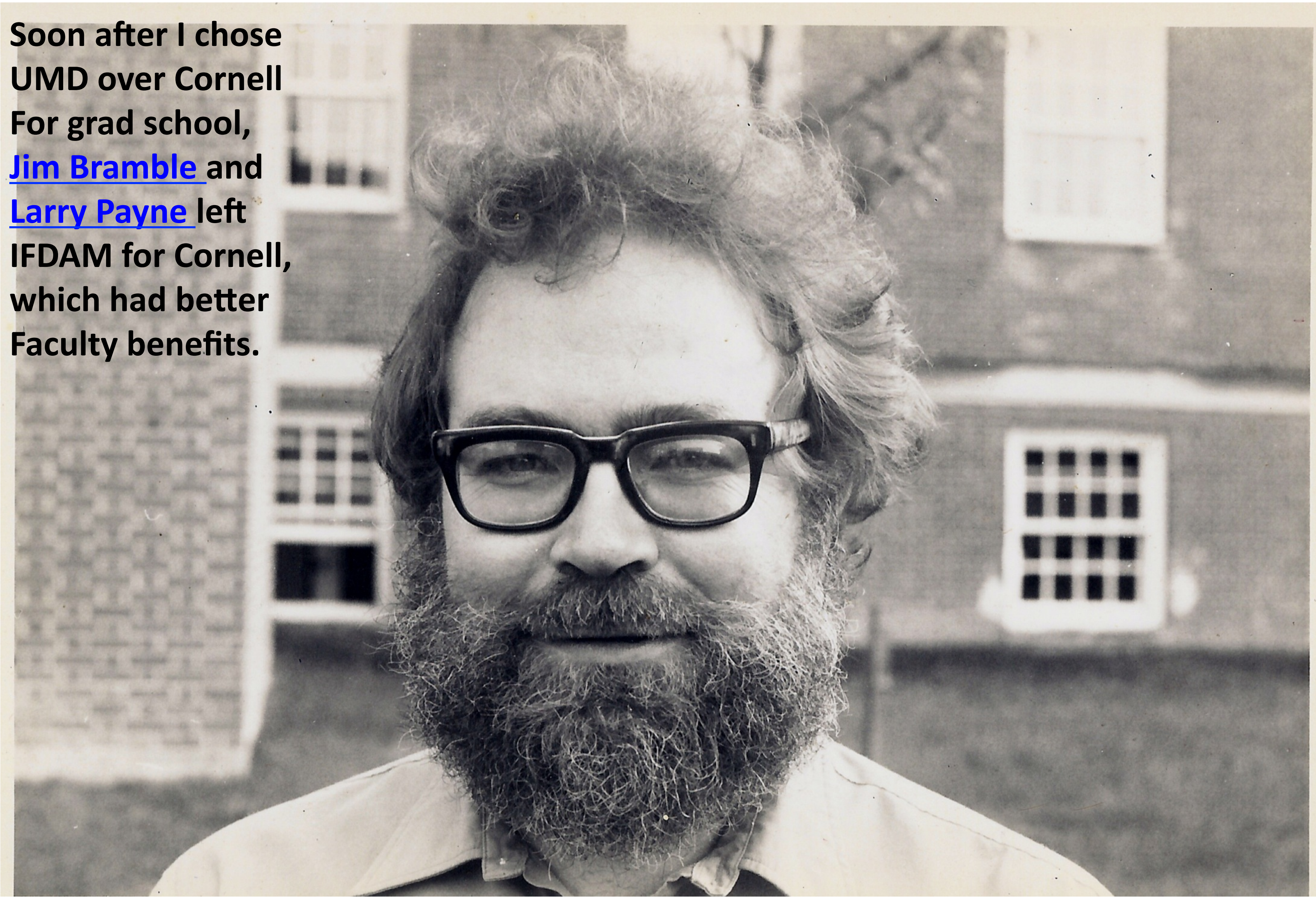
$$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} = \nu\frac{\partial^2 u}{\partial x^2}$$



This is a numerical simulation of the inviscid Burgers Equation in two space variables up until the time of shock formation.

Various slides from Wikipedia

Recollections about some early Institute faculty
IFDAM was in the math bldg until 1966, seen behind me here



Soon after I chose UMD over Cornell For grad school, Jim Bramble and Larry Payne left IFDAM for Cornell, which had better Faculty benefits.

ROBERT ZWANZIG

Joined IFDAM in 1966

Winner of The Irving Langmuir Award

Distinguished University Professor IFDAM/IPST

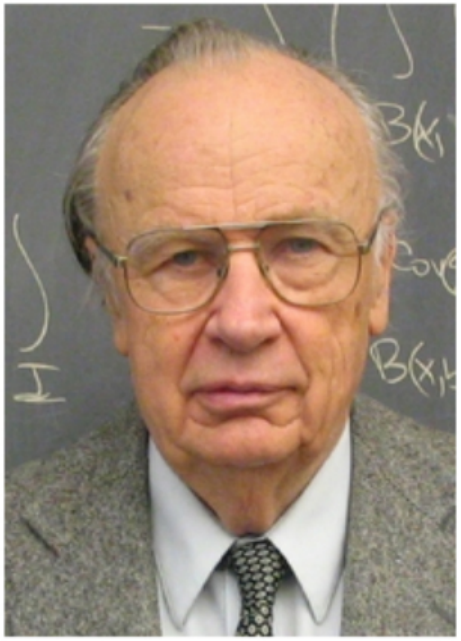
Member, National Academy of Sciences

ROBERT WALTER ZWANZIG (born 04.04.1928) is a distinguished theoretical physicist best known for his works in statistical physics and nonequilibrium statistical mechanics and thermodynamics. He belong to persons whose works contributed substantially to the irreversible statistical thermodynamics and many-particle physics.

Research Statement:
Theoretical research in chemical physics and biophysics; statistical mechanics; protein folding kinetics.

In the early 1960s, ROBERT ZWANZIG made a series of important researches on nonequilibrium thermodynamics and irreversible statistical mechanics. He formulated a projection formalism, which was termed the MORI-ZWANZIG projection method in statistical mechanics. In 1960 Professor ROBERT ZWANZIG published an article entitled: "Ensemble Method in the Theory of Irreversibility", J. Chem. Phys. 33 (1960) pp.1338-41 .

Babuska



Ivo M. Babuska

Robert B. Trull Chair in Engineering
Professor, Aerospace Engineering and Engieering Mechanics
Professor, Mathematics
ICES Senior Research Scientist

The University of Texas at Austin
Department of Aerospace Engineering and Engineering Mechanics

Email: babuska@ices.utexas.edu

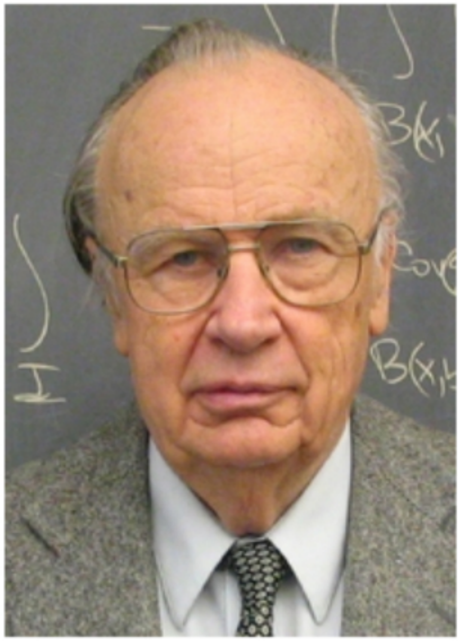
IFDAM/IPST 1968-1996,
Distinguished University Professor

Research Interests

Ivo M. Babuska studied civil engineering at the Technical University, Prague where he received the Dipl. Ing in 1949. In 1951 he received the degree Dr. Tech. From 1949 he studied at Mathematical Institute of Czechoslovakia Academy of Sciences and then was the head of the Department of Partial Differential Equations. In 1955 he received a PhD in Mathematics and in 1960 D.Sc. in Mathematics.

Numerical colleagues in IFDAM: John Osborn, Jim Bramble, Jim Ortega, Werner Reinboldt,

Babuska



Ivo M. Babuska

Robert B. Trull Chair in Engineering
Professor, Aerospace Engineering and Engieering Mechanics
Professor, Mathematics
ICES Senior Research Scientist

The University of Texas at Austin
Department of Aerospace Engineering and Engineering Mechanics

Email: babuska@ices.utexas.edu

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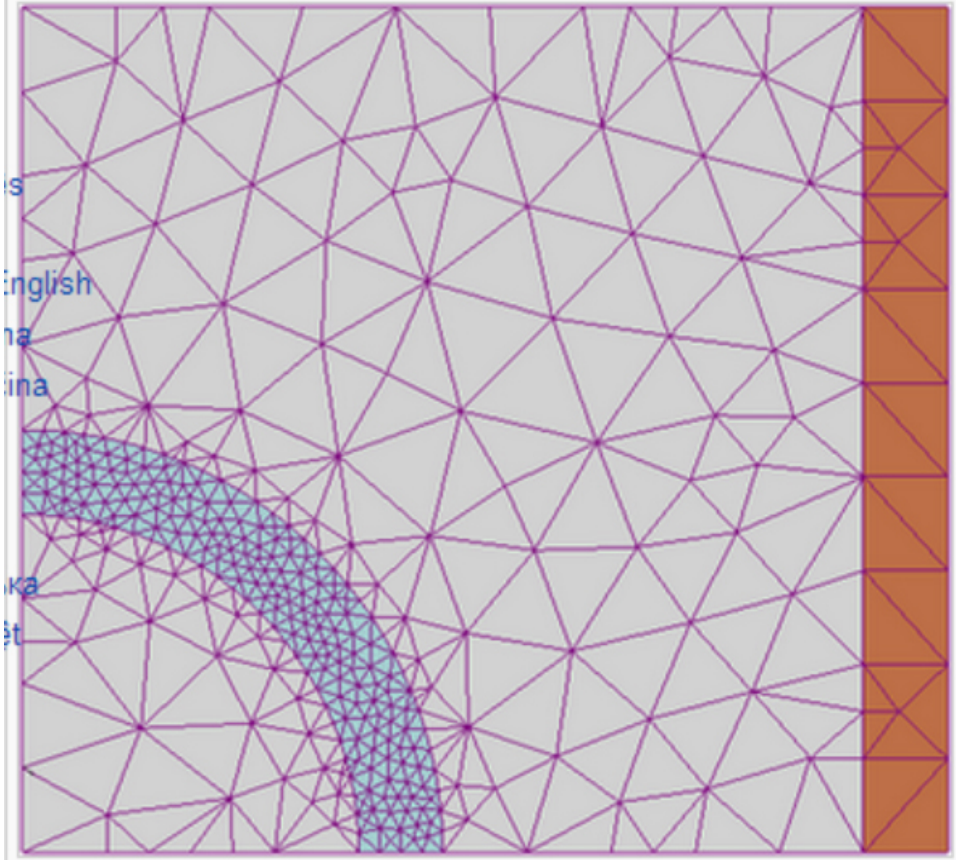
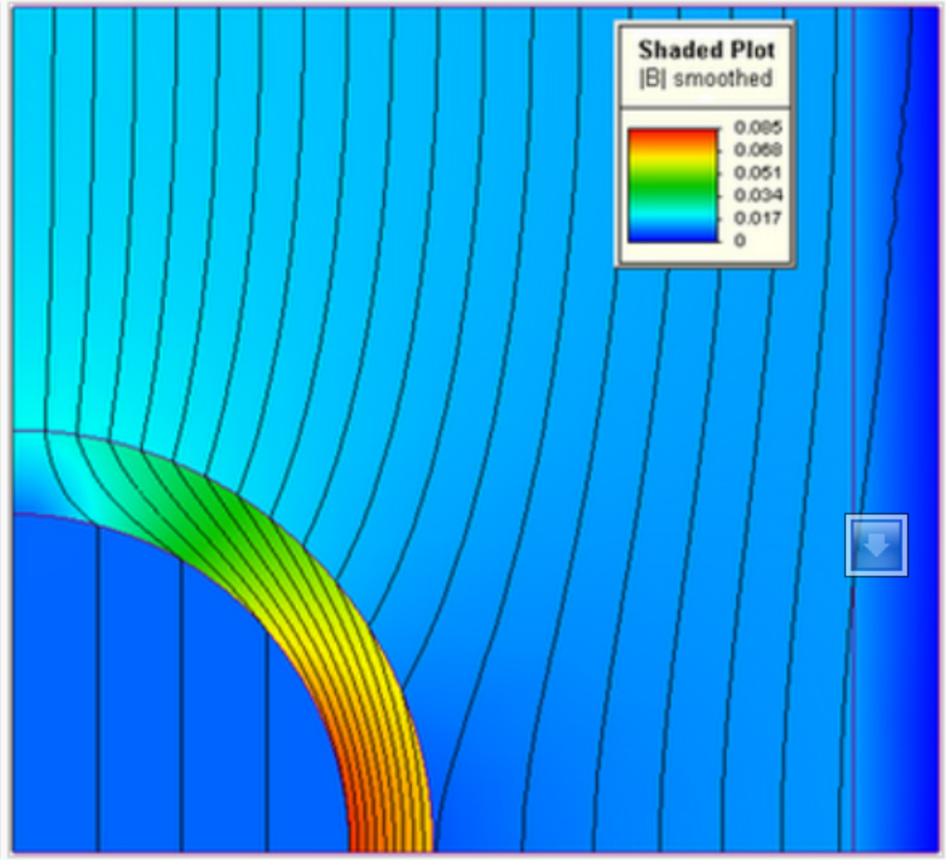
Bruce Kellogg, Bert Hubbard and
in Math: John Osborn

Finite element method



FEM mesh created by an analyst prior to finding a solution to a magnetic problem using FEM software. Colours indicate that the analyst has set material properties for each zone, in this case a conducting wire coil in orange; a ferromagnetic component (perhaps iron) in light blue; and air in grey. Although the geometry may seem simple, it would be very challenging to calculate the magnetic field for



FEM solution to the problem at left, involving a cylindrically shaped magnetic shield. The ferromagnetic cylindrical part is shielding the area inside the cylinder by diverting the magnetic field created by the coil (rectangular area on the right). The color represents the amplitude of the magnetic flux density, as indicated by the scale in the inset legend, red being high amplitude. The area inside the cylinder

Steve Brush Joined IFDAM 1968

Stephen Brush Awarded the 2009 Pais Prize

By Paul Halpern, Chair, Pais Prize Selection Committee

2009 Pais Prize winner Stephen Brush of the University of Maryland

The American Physical Society and the American Institute of Physics have selected Stephen G. Brush, a physicist and historian of science, to receive the 2009 Abraham Pais Prize for the History of Physics "for his pioneering, in-depth studies in the history of nineteenth and twentieth-century physics."

Brush joins an impressive list of previous Pais Prize winners including Martin J. Klein (2005), John L. Heilbron (2006), Max Jammer (2007), and Gerald Holton (2008).

Born on 12 February 1935 in Bangor, Maine, Brush received a bachelor's degree in physics from Harvard University in 1955. A Rhodes Scholar, he pursued graduate study at Oxford University, earning a doctorate in theoretical physics in 1958. From 1959 to 1965, he worked as a researcher at the Lawrence Radiation Laboratory in Livermore, California, where he studied plasmas using Monte Carlo simulations and explored theories of viscosity. His discovery, using early computer simulations, that classical plasmas undergo phase transitions to solid states proved important for models of stellar and planetary structure.

Brush's interests soon turned to the history of science. He wrote a comprehensive history of molecular-lattice models in statistical physics, tracing their origins back to the work of Wilhelm Lenz and Ernst Ising in the 1920s. Entitled "History of the Lenz-Ising Model," his often-cited paper was published in Reviews of Modern Physics.

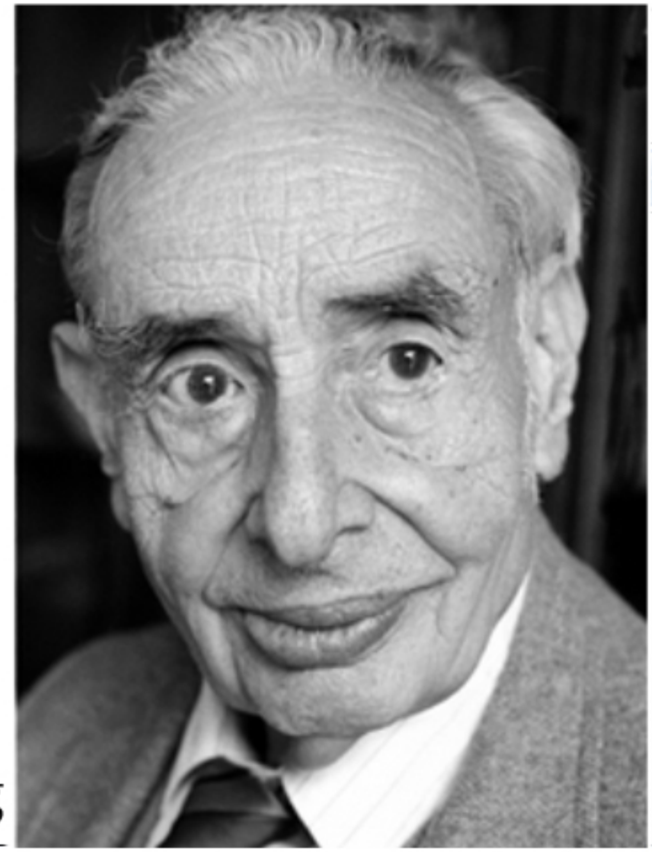
In the mid-1960s, Brush participated in developing the "Harvard Project Physics" course, in a program led by Holton, F. James Rutherford, and Fletcher Watson that was funded by the National Science Foundation and several private foundations. Designed for high-school students, this innovative curriculum used books, films, demonstrations and other materials to weave history and philosophy into the framework of physics education.

In 1968 Brush joined the faculty of the University of Maryland, where he was appointed Associate Professor in the History Department as well as at the Institute for Fluid Dynamics and Applied Mathematics (later the Institute for Physical Science and Technology). The University's first full-time historian of science, he became Professor in 1971 and Distinguished Professor of the History of Science in 1995.

Walter M. Elsasser

From Wikipedia, the free encyclopedia

1968-74 IFDAM/IPST/Director of the Material Research Center, Ret's 1974



Walter Maurice Elsasser (March 20, 1904 - October 14, 1991) was a German-born American physicist considered a "father" of the presently accepted dynamo theory as an explanation of the Earth's magnetism. He proposed that this magnetic field resulted from electric currents induced in the fluid outer core of the Earth. He revealed the history of the Earth's magnetic field through pioneering the study of the magnetic orientation of minerals in rocks.

In 1987, he was awarded the National Medal of Science "for his fundamental and lasting contributions to physics, meteorology, and geophysics in establishing quantum mechanics, atmospheric radiation transfer, planetary magnetism and plate tectonics.".