Problems and Methods in Mathematical Physics. J. Elschner *et al*. Birkhäuser Verlag, P.O. Box 133, CH-4010, Basel, Switzerland. Vol. 12. 536 pp. Price: sFr198/DM 248.

This is a collection of articles dedicated to the memory of Siegfried Prösdorf. It is the Proceedings of the 11th TMP held at Chemnitz (Germany) from 25 to 28 March 1999. Published in the series 'Operator Theory, Advances and Applications'.

Siegfried Prösdorf has been called the most prolific mathematician that ever worked in the areas of integral equations and their numerical analysis. In more than 130 publications, among them five books and numerous survey articles, he dealt with problems in operator theory, in the theory and numerical analysis of integral equations, pseudodifferential equations and boundary value problems, in approximation theory and boundary element methods. It is only appropriate that the memorial volume should contain contributions in these areas.

It is difficult to compartmentalize these contributions in any one of the above areas. A broad classification would be as follows:

Singular integral operators and their approximate solution – Böttcher, Karlovich and Rabinovich study the algebra generated by Cauchy singular operators and the operator of complex conjugation on a weighted Lebesgue space. The method of approach is based on transforming the operator locally into Mellin pseudodifferential operators. Laurita and Mastroianni re-examine a quadrature method for Cauchy singular integral equations with constant coefficients. They construct a polynomial approximation of the system and give estimates in mean weighted norm of the error. Grigorieff and Sloan apply the qualocation and collocation method to index-zero singular integral equations with piece-wise continuous coefficients using continuous splines defined on a quasi-uniform mesh. Junghans and Mastroianni apply a Banach algebra technique to the investigation of the stability of collocation method with respect to the Chebyshev nodes of the second kind for an approximate solution of a Cauchy singular integral equation.

Wavelets – Bourgeois and Nicaise use the biorthogonal wavelet approximation method for the heat equation in its integral formulation with Dirichlet and Neumann boundary conditions. The unknown solutions of the integral equations belong to anisotropic Sobolev spaces and are approximated by the Galerkin method using an appropriate wavelet basis. Harbrecht and Schneider examine the implementation for the wavelet Galerkin scheme in two dimensions using biorthogonal wavelets. They develop an optimal algorithm for the computation. Rathsfeld considers the problem of a smooth boundary surface of a three-dimensional domain and the space of piece-wise linear functions defined over a uniform triangular grid. A wavelet basis is introduced which is a variant of the well-known three-point hierarchical basis. These wavelets can also be used for finite element methods. Prestin and Selig give a particular class of orthogonal trigonometric Schauder bases for $C_{2\pi}$ by periodic wave packet functions. These bases are of minimal growth of the polynomial degree. The corresponding approximation error is asymptotically optimal.

Riemann–Hilbert problem – Bergher and Dai study the solvability of the Riemann–Hilbert for a singular Venkua system. The number of continuous solutions is shown to depend not only on the index, but also on the location and type of the singularities. Efendiev and Wendland introduce orientable and non-orientable Riemann–Hilbert problems. The number of connected components in the two cases differ significantly. The degree of quasilinear Fredholm maps is used to prove global existence of solutions.

Pseudodifferential and other operators – Gorenfeld and Mianardi present three random walk models, discrete in space and time for the symmetric case of space-fractional diffusion processes. For properly scaled transition to vanishing space and time steps, these models converge to the corresponding time-parametrized stable probability distribution. Prösdorf and Yamamoto consider an ill-posed linear compact operator equation in a Banach space. They adopt a discretization of the Lavrent'ev regulation to reconstruct the solution. Gohberg and Krupnik establish a connection between the determinant of a polynomial operator pencil and the characteristic numbers of this pencil. They give three examples from trace class and nuclear operators.

Problems arising out of physical phenomena – Plato investigates a parameter estimation problem with noisy data, which arises as an inverse problem in ground filtration. In appropriate Hilbert spaces, the problems can be formulated as a linear, non-compact, ill-posed problem with a model perturbation that can be estimated only at the solution of the problem. von Wolfersdorf studies the plane potential flow of an inviscid incompressible fluid around and through a circular cylinder of porous material. It reduces to a nonlinear boundary value problem of Poincaré type and leads to an infinite system of algebraic equations and a related nonlinear integral equation. Vainikko constructs a fast solver for the generalized airfoil equation, which is periodized with the help of cosine transforms. The fast solver is constructed on the basis of a fully discrete version of trigonometric collocation method with product integration. Kravchenko gives a new approach to studying Dirac equations with potentials and Maxwell's system. It is based on the possibility of reformulation of these equations in terms of complex quarternions. Natroshvili and Tediashvili study a direct mixed-type boundary value problem for a generalized Helmholtz equation, when in the sound-soft part the Dirichlet condition is given, while in the sound-hard part of the boundary, the Neumann condition is prescribed. Elschner and Schmidt examine problems of diffraction arising in optimal design of binary gratings. They obtain the form of the derivative of the reflection and transmission coefficients.

Approximation theory – Hackbusch and Khoromskij develop a class of matrices with improved data sparsity to approximate elliptic operators in one, two and three-dimensions. In BEM applications, this reduces the order of expansion. Grudsky establishes theorems about the representation of functions with given asymptotics of the argument in the neighbourhood of a discontinuity in the form of a Blaschke product. A theory of normal solvability for Toeplitz operators on the unit circle whose symbols have oscillating discontinuities, is constructed. Luther and Mastroianni show that the result regarding Fourier projections in the space of all 2π–

periodic L^{∞} functions with respect to normalized Chebyshev polynomials also holds for Jacobi polynomials in a weighted space. Roch shows that fractality is a property of an approximation method which makes certain limiting processes uniform. Moreover, he shows that every approximation sequence possesses a fractal subsequence. Maz'ya and Shaposhnikova investigate properties of maximal Banach algebra between Bessel potential spaces.

The book is a true memorial to Siegfied Prössdorf in that it mirrors all the areas in which he worked and is a tribute to him from those who knew and worked and admired him.

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The Intelligent Genome – On the Origin of the Human Mind by Mutation and Selection. Adolf Heschl. (Translated from German). 2002. 362 pp. Price: US$ 49.95/Euro. 39.95.

Let me start this review with a summary of what in my opinion are the most serious drawbacks of this book. It is poorly written and poorly translated, so poorly as to make the book unnecessarily difficult to read. The absence of a strong editorial hand is apparent on each page; each argument comes laden with the thickest prose and the most Germanic constructions, each clause festooned with sub-clauses. Here is a typical sentence, quoted verbatim:

'Since if we hear again and again that the species *Homo sapiens* still carries in itself some important biologically determined residues of its physical and even behavioural constitution which should be taken into consideration, but at the same time excluding specifically human characters such as thinking, consciousness, language, morality, in short the capability for cultural tradition, from biological evolution, then we must ask ourselves whether it is not so much a scientific boundary which is touched here, but rather an ideological taboo.'

I mention these somewhat obvious flaws because they are obvious, and also because they manage to make some of the more thought-provoking arguments in the book needlessly obscure and obtuse. I have other criticisms to make of the book, but this will not be on matters of style and presentation.

What this book is about, is a proposition: Life is cognition. Or as Heschl puts it, $L = C$, this equation being the central thesis of a paper written by the author in the *Journal of Theoretical Biology* over ten years ago. This is not a rehash of the Cartesian point of view ('Je pense, donc je suis') put forth three centuries ago, which must surely be among the earliest and the most widely known philosophical points of view concerning the relationship between awareness and existence. Heschl is an evolutionary epistemiologist (which subject he defines as 'the ambitious attempt to provide a biological explanation for complex cognitive capacities in human beings', and which he recognizes 'is yet far from being accepted by the scientific community as a new and serious discipline'; in short, he is interested in the evolution of human intelligence), a polymath who combines research in biology with philosophy, ethology and cognitive science.

The genome – the human genome to be specific – is a widely discussed entity these days. The availability of the complete genomic sequence and its extensive analysis have created new fields of study and have given fresh impetus to old, deep questions. The apt metaphor is the order of the day: the DNA is the blueprint of life ('ex DNA omnia'), genes can be selfish, there is 'junk' DNA. And now, there is the intelligent genome.

Genomic sequence information is, by and large, static. That is to say, DNA sequences contain a roster of genes and other features that we have learned to recognize (such as promoters, repetitive elements, transposons, telomeric regions, etc.), with no indication as to how and when genes may be expressed, how the different entities interact among themselves, or how life (however difficult that is to define) sustains. There is another order of magnitude of difficulty in asking about the connection between the genome and behaviour.

Heschl's book treads on matters arising from this last sort of questions: the subtitle of this book is *On the Origin of the Human Mind by Mutation and Selection*. What determines human intelligence and human behaviour – nature or nurture? Does natural selection apply to the evolution of cognition itself?

The traditional viewpoint in discussing the evolution of human intelligence, articulated for instance in *The Theory of Evolution*, by Maynard-Smith, is as follows. Intelligence in primates evolved as an adaptation to living socially and in coping with the complex demands of maintaining harmony and hierarchy in such a situation. The use of intelligence in other tasks (doing theoretical physics, say) was a spin-off. But even within the traditional viewpoint, the realization was there that humans are unique in that we can manipulate selection to an unnatural extent. Not just to create different dog, cat, or pigeon breeds, but also to manipulate the DNA at a cellular level as is now becoming increasingly possible, in order to practice freedom of genetic choice and control.

A contrast has been made by several people, Popper, Dawkins and Gould (Steven J.) among them, between human evolution and human cultural evolution. Do these march to the beats of different drums? There is no serious divergence of views on the question of human evolution which falls well within the Darwinian framework, but on the matter of cultural evolution, opinions can and do differ. Gould goes so far as to say that cultural evolution is Lamarckian, and therefore moves much faster, while the more moderate Popperian argument is that human cognition (and its ancillary features such as reason and logic) makes it possible for us to subvert natural selection (the paraphrasing is mine). And to Dawkins, what sets man apart from all other species 'can be summed up in one word: "culture".'

Heschl sets out to question this, whether different rules need apply to the evolution of human intelligence. He proposes a critical examination of 'life' which leads him to the conclusion that life equals cognition. He starts by defining living as having the following features.

(a) A demarcation between the system and the surrounding (say by a cell wall or a membrane or skin): a natural definition of the self and the other.