ENCYCLOPAEDIA OF MATHEMATICS

Supplement Volume I

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The present volume of the ENCYCLOPAEDIA OF MATHEMATICS is the first of several (planned are three) supplementary volumes.

In the prefaces to the original first ten volumes I wrote:

"Ideally, an encyclopaedia should be complete up to a certain more-or-less well defined level of detail. In the present case I would like to aim at a completeness level whereby every theorem, concept, definition, lemma, construction, which has a more-or-less constant and accepted name by which it is referred to by a recognizable group of mathematicians occurs somewhere and can be found via the index."

With these three supplementary volumes we go some steps further in this direction. I will try to say a few words about how much further.

The first source of (titles of) articles was the collective of users of the original 10 volume ENCYCLOPAEDIA OF MATHEMATICS. Many users transmitted suggestions for additional material to be covered. These suggestions were taken seriously and checked against the 3.5M keyword list of the FIZ/STN database MATH in Karlsruhe. If the hit rate was 10 or better, the suggestion was usually accepted.

For the second source I checked the index of volumes 1–9 against that same key phrase list (normalized). Everything with a hit frequency in the normalized list of 40 or better was checked and, if not really present—a casual mention did not suffice—resulted in an invitation to an expert to contribute something on it.

This 'top 40' supplementary list already involves more articles than would fit in a single volume alone and the simple expedient was followed of processing first what came in first (while being careful about groups of articles that refer heavily to each other and other matters such as timeliness). However, the three supplementary volumes together will surely cover the whole ‘top 40’ and actually go one step deeper, roughly to the level of the 'top 20'.

For the final (as far as I can see at the moment only electronic) version of the ENCYCLOPAEDIA OF MATHEMATICS (WEB and CDROM both) I hope and expect to go as far as the ‘top 6’. This means an estimated 32000 articles and an 120K standard key phrase list, a four-fold increase over the printed 13-volume version. It should be noted that if one actually checks one of these ‘top 6’ standard key phrases in the database MATH, the number of hits is likely to be quite a bit higher; such a search will also pick mentions in title and abstract (and not only those in the key-phrase field).

The present volume has its own index. This index is structured exactly like Volume 10, the index to Volumes 1–9. For details I refer to the Introduction to that index volume.

The number of authors involved in this volume is substantial and in a sense this ENCYCLOPAEDIA is more and more a community effort of the whole mathematical world. These authors are listed collectively on one of the preliminary pages, and individually below their contributions in the main body.
ACCESSIBLE RANDOM VARIABLE

open questions. For example, it is not always easy to
tell whether a function is accessible or not, and it is
unknown if \( L^p(\mathbb{R}, m) \) is complete (cf. Complete topo-
logical space).

For a detailed discussion of white noise theory via the
canonical Gaussian measure and accessible random vari-
ables, and applications of that theory to non-linear
filtering, see [6]. It contains many references to the ear-
er literature, including references to the seminal work
of I. Segal and L. Gross. Some more recent papers mak-
ing use of the theory are [1], [4], [7].

References
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MSC1991: 60B11, 60H05, 60H07

G.W. Johnson

ACCURACY. accuracy analysis – A systematic study of the precision and errors of numerical and statistical calculation and estimation procedures. See, e.g.,
Error. Errors, theory of.

MSC1991: 62-XX, 65-XX

M. Hasegawa

ACTION POTENTIAL – An electrical disturbance propagated as a wave along an axon (elongated part of a nerve cell) that is considered as the way information is transmitted in the nervous system of animals. Cardiac, muscle and some endocrine cells also display action po-
tentials with similar properties.

An action potential is observed experimentally as a
displacement of voltage from its equilibrium value that
takes place in a limited part of the axon and that retains
its shape while it is propagated with constant speed. It
appears in response to a sufficiently large stimulus, sub-
threshold stimulation producing a transient departure
from equilibrium that is not propagated. After the pass-
ing of an action potential the axon apparently returns
to its equilibrium state but the threshold value is raised
for some time, the refractory period.

A special experimental setting, called a current clamp,
eliminates spatial variations and the voltage curve in this case is called a stationary action potential.

Action potentials are described mathematically as
undamped travelling-wave solutions of the Hodgkin-
Huxley system.

References
[4] Rinzel, J.: 'Electrical excitability of cells, theory and ex-
periment: review of the Hodgkin Huxley foundation and an
I.S. Labourie

MRC1991: 92C20

ACTIVATION ENERGY – A concept originating in the theory of chemical reactions. It plays an important role in combution theory.

The evolution of a chemical reaction is determined by its specific-reaction rate constant, usually denoted by \( k \).

This quantity depends mainly on the temperature, \( T \).

For a one-step chemical reaction, its functional depend-
ence is given empirically by the Arrhenius expression:

\[ k = A \exp\left(-\frac{E}{RT}\right) \]

Here, \( R \) is the universal gas constant,

\( E \) the activation energy, and \( A \) the frequency factor

for the reaction step; \( E \) is independent of \( T \), while \( A \)

may depend weakly (for example, polynomially) on \( T \).

At the molecular level, a chemical reaction is a col-
lesion process between reactant molecules, from which
reaction products emerge. The molecules move on a potential-energy surface, whose shape is determined by a solution of the Schrödinger equation. A configu-
ration of the reactant molecules corresponds to a local
minimum in one region, and a configuration of the re-
action products to a local minimum in another region,

where the two minima are generally separated by a bar-
rier in the potential-energy surface. At a saddle point
on the barrier, the height of the surface above the energy
of the reactant region assumes a minimum value. A col-
lesion of the reactant molecules can produce products
only if the energy of the reactants (for example, their
kinetic energy) exceeds this minimum height. The min-
imum barrier height defines the activation energy, \( E \).

It is the energy the reactants must acquire before they can
react. In practice, the activation energy is determined experimentally, by measuring \( k \) at various values of \( T \)

and making a best straight-line fit through the data in \( k \)

versus \( 1/T \).

Activation-energy asymptotics. Activation-energy
asymptotics play an important role in combustion
theory, in the study of diffusion flames.