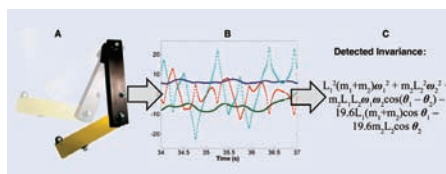


Computer algorithm reveals the complex laws of physics

A large part of science involves searching for the analytical expression of physical laws that govern various systems, which often depend on various symmetries and invariants.

Attempts to automate the process have in the past proved unsuccessful, but now two researchers seem to have succeeded where others have failed.

Michael Schmidt and Hod Lipson of Cornell University have developed computer code that looks at data from physical systems ranging from simple harmonic oscillators to chaotic double pendula and proceeds to infer the appropriate Hamiltonians, Lagrangians and conservation laws – and all without any prior knowledge. “Might this process diminish the role of future scientists?” the researchers ask at the end of their paper. “Quite the contrary: scientists may use processes such as this to help focus on interesting phenomena more rapidly and to



In this example, the researchers captured the velocities of a chaotic double-pendulum (A) using motion tracking (B), and automatically searched for equations that describe a single natural law relating these variables. The algorithm found the conservation law (C), which turns out to be the double pendulum's Hamiltonian.

interpret their meaning.” The software could provide valuable tools to help scientists work out the dynamics underlying all sorts of otherwise-confusing systems.

Further reading

M Schmidt and H Lipson 2009 *Science* **324** 81.

Ultrasonic cavitation of water speeds up thorium decay

It is a common belief that radioactive decay rates are unchanged by external conditions, despite many examples of small shifts (particularly involving external pressure and K-capture decays) being well documented and understood. However, Fabio Cardone of the Institute per lo Studio dei Materiali Nanostrutturati in Rome and colleagues have shown a dramatic increase – by a factor of 10 000 – in the decay rate of thorium-228 in water as a result of ultrasonic cavitation. Exactly what the physics is and whether or not this sort of effect can be scaled up into a technology for nuclear waste treatment remain open issues.

Further reading

F Cardone, R Mignani and A Petrucci 2009 *Phys. Lett. A* **373** 1956.

Symmetry cuts face space

The computerized recognition of human faces has long been considered a difficult problem, largely because of the enormous dimension of the “space of distinct faces”, or “face space”, for short. Now Lawrence Sirovich and Marsha Meytlis of the Mount Sinai School of Medicine in New York City have shown that the dimension of this space is much smaller than had been previously thought.

The key insight is that perceptually, great use is made of the approximate symmetry

between the left and right sides of the face. This means that the bulk of the relevant information lies in deviations from perfect symmetry or an artificially symmetrized facial image. This leads not only to a face recognition algorithm that is nearly 100% accurate, but also to a way of generating interesting and realistic synthetic faces.

Further reading

LSirovich and MMeytlis 2009 *PNAS* **106** 6895.

Extending Faraday

According to Faraday's law, a changing magnetic field will produce an electric field, so a static magnetic field should produce no electric field. However, Phan Nam Hai and colleagues of the University of Tokyo have noticed that there is another subtlety when electron spins are considered. In this case, the motion of a spinning electron can cause a

local change in the magnetization of material and an associated Faraday-law electric field.

In suitable tunnel junctions containing MnAs quantum nanomagnets, this effect can lead to huge magnetoresistances of up to 100 000 % – an effect that could lead to new magnetic sensors as well as new active devices including a “spin battery”.

Further reading

Phan Nam Hai *et al.* 2009 *Nature* **458** 489.

Mixing nature with metals opens up an exciting new field

Two recent papers show how mixing a little bit of something from nature with a little metal from the lab can lead to interesting results. As a consequence, an exciting new field mixing natural products and standard lab techniques and chemicals seems to be emerging.

D Matthew Eby of Florida's Tyndall Air Force Base and colleagues showed that using the enzyme lysozyme from chicken eggs mixed with silver acetate in methanol, and exposing the mixture to light, is an inexpensive way to produce copious quantities of antibacterial silver nanoparticles. Meanwhile, Seung-Mo Lee of the Max Planck Institute of Microstructure Physics in Halle and colleagues have shown that zinc, titanium or aluminium can greatly enhance the toughness of spider silk.

Further reading

D Matthew Eby *et al.* 2009 *ACS Nano* **3** 984.
S-M Lee *et al.* 2009 *Science* **324** 488.