Summary in English

Johan Hoffman and Claes Johnson, *The Mathematical secret of Flight.*

Are you afraid of flying? If so there may be little comfort in being assured by NASA that all the popular explanations of flight are wrong and furthermore that no authoritative explanation is available. The purpose of this article is to give a new mathematical (and physical) explanation of the phenomenon of flight intending to plug up this disconcerting gap. Whether it will actually assuage your fears is quite another matter.

The explanation is based on computational solutions to the standard mathematical model of fluid mechanics - the Navier-Stokes/Euler equations, solutions which have recently led to new discoveries of the dynamics of turbulent air-flows around a wing. It is shown that the large lift/drag quotient required is effected by a fortunate combination of certain features of slightly viscous incompressible flow including a crucial instability mechanism.

The lift L is caused by the down-wash of air engineered by the wing, while the drag D is counteracted by leading edge suction. The great mystery is how a small amount of drag can generate so much lift. In fact L/D needs to be large (10 or more) to make flight feasible. Elementary considerations by Newton, later refined by d'Alembert showed that flight was mathematically impossible. This is known as d'Alemberts paradox. The feat of the brothers Wright further rubbed in theoretical embarrassment. The Russian Zhukovsky saved fluid-dynamics from complete collapse by explaining how lift was generated through the perturbation by a circular flow, supplemented by an explanation of drag in terms of a viscous boundary layer later given by the physicist Prandtl. Those were, however, not enough to transform the art of an aircraft engineer into a science, and are in fact shown to be incorrect. The classical fallacy was to concentrate on the potential flow, a highly unstable mathematical solution with no physical relevance. Instead one should consider the far more stable solution involving a turbulent fluctuating layer. Lift and drag are inseparable, generated by the same mechanism of counter-rotating low-pressure rolls of the turbulently swirling flow.

Olav Gebhardt og Marius Overholt, *Et kombinatorisk kuriosum* (Norwegian).

Given n strands of black and white pearls, each of length k. Assume that each pair of strands agree in at least m more positions than they disagree, and that at each position the excess number of pearls of one color over the other across the strands is at most d. The authors find a necessary condition on n,k,m and d, and prove it both combinatorially and by linear algebra.

Tord Sjödin, *Gram-Schmid's algoritm för en allmän vinkel*(Swedish).

The classical Gram-Schmid algorithm allows you to exhibit an orthogonal basis with respect to a positive definite form (the normalization that each basis element has length one is of course trivial). In this paper the question is posed whether it also works when orthogonality is replaced with some other angle θ. The author shows that it is possible if and only if $-\frac{1}{n-1} < \cos\theta < 1$ where n is the dimension of the space.