



## Drei Mathematikvorträge

Die Natan-Redaktion erhielt von Professor Heersink die Inhaltsangaben der drei Vorträge, die die beiden Professoren von der Universität Cantabria (Santander, Spanien) im Juni 1994 an der TU Graz halten werden.

Die Vortragszeiten und -orte sollen sein:

- \* Vortrag 1 von Tomas Recio: Dienstag, 7. Juni 94, 17:00 ct., HS P2
- \* Vortrag 2 von Tomas Recio: Mittwoch, 8. Juni 94, 17:00 ct., HS P2
- \* Vortrag 3 von Jaime Gutierrez: Donnerstag, 9. Juni 94, 18:00 ct., HS BE01.

### 1. Computer algebra and motion planning in robotics. (Tomas Recio)

About ten years ago the work of Schwartz-Sharir rised interest on the symbolic approach for the solution of some basic problems in Robotics. Nowadays it will be impossible to summarize in one talk the wealth of results produced from the interbreeding of this two fields: Computer Algebra and Robotics. We shall focus in this talk on some prototypical accomplishments: solution to the piano mover's problem (as in the work quoted above), computing the configurations of the Stewart platform (a la Lazard), solving the inverse kinematics and path tracking problems (a la Buchberger). In all these cases a purely algebraic formulation yields to a polynomial system problem that requires yet further symbolic techniques to be efficiently handled.

### 2. Voronoi diagrams, models of computation and robotics. (Tomas Recio)

Computational geometry is probably a more natural approach to efficient robotics than computer algebra. Voronoi diagrams are sometimes a convenient formulation for safest paths in robot motion planning. Nevertheless, as they are metric dependant objects, it is required that some natural metric is given on the set of rigid motions in order to compute such diagrams (or at least their topological shape). On the other hand, the complexity analysis of algorithms in computational geometry is somehow a link between this and computer algebra: some algorithms are shown to be optimal (in some models of computation such as the one of Blum-Shub-Smale) by using sophisticated tools from real algebraic geometry. The talk will present the fact that all this web interrelating robotics, computer algebra and computational geometry, collapses when dealing with the computation of (even the shape of) Voronoi diagrams in theoretical robotics under the BSS model.

### 3. FRAC: a package for decomposing rational functions and its applications. (Jaime Gutierrez)

In this talk we shall present a symbolic computation MAPLE package (FRAC) that performs (if existing) the decomposition ( $f(x)=g(h(x))$ ) of a univariate polynomial or rational function. This tool can be applied to several contexts: we shall comment here three cases, namely, simplifying inver-

se kinematic equations in Robotics (after Kovacs-Hommel), detecting improper parameterizations of curves, and helping to solve symbolically equations and integrals. FRAC contains, moreover, some other programs for the algebraic manipulation of parametric varieties that can be helpful in CAD.

### Kommentar von Herrn Recio zu den 3 Vorträgen:

As I have mentioned before, the style of the talk will be kept rather informal, allowing people from various interests and backgrounds to follow the main ideas. The mathematics on the talks can be kept, I am afraid, quite elementary. Moreover, there is almost always a physical or geometrical description of what we want to do or to compute that helps the audience understanding the explanation.

*Rudolf Heersink*

### Kleiner Scherz am Rande

Wieder einmal steht die These im Raum, daß alle ungeraden Zahlen Primzahlen seien. Ein Mathematiker, ein Physiker, ein Elektrotechniker und ein Informatiker nehmen sich des Problems an.

Der Mathematiker: "1,3,5,7 sind Primzahlen, 9 ist keine, ergo ist die These widerlegt!"

Der Physiker: "1,3,5,7 sind Primzahlen, 9 ist keine, 11, 13 sind wieder Primzahlen, also stimmt die Theorie, neun war ein Meßfehler!"

Der E-Techniker: "1,3,5,7,9,11,13 sind Primzahlen. Die These ist richtig."

Der Informatiker fragt sich nach ungeraden Primzahlen: "1 ist eine Primzahl, 3 ist eine Primzahl, 5 ist eine Primzahl, 7 ist eine Primzahl, 7 ist eine Primzahl, 7 ist eine Primzahl...!"