

PHYSICS PROBLEM SOLVING: ISAAC-II

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ISAAC-II, a program which solves physics problems stated in English, will be demonstrated in real time. A notebook of problems which have been solved by the program will be displayed; the demonstration will include problems taken from this set. In addition, new problems in elementary physics (stated entirely in English, i.e., not requiring a diagram as part of the problem statement) contributed by conference attendees will be accepted, and will be attempted by the program.

This program, a successor to our earlier ISAAC program, first parses the sentences of the problem statement to build an internal model of the objects in the problem and their relationships; this model is stated in terms of real-world objects (cars, people, etc.). Using rules which examine qualitative and quantitative features of objects and relationships, the program chooses views of objects (or groups of objects) as physical systems (e.g., "rigid body" or "uniform acceleration from rest"). This set of models gives rise to a set of equations which can be solved to find the answer to the problem. The internal model of the objects is also used to generate a picture of the problem; an example of such a picture (generated by ISAAC) is shown in Figure 1.

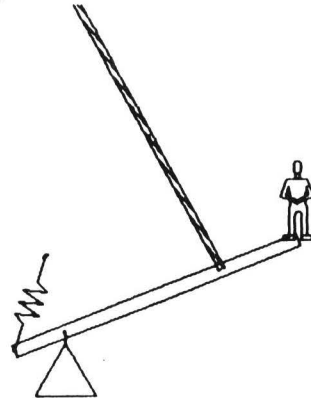
The major difference between this program and ISAAC lies in the choice of problem solving methods. ISAAC could solve only rigid body statics problems (which limited the range of solution methods needed); it also wrote a large number of equations which were solved by brute force. ISAAC-II has a larger repertoire of problem solving methods (even for the "same" type of problem); this enables it to select the best method for a particular problem. The resulting solutions are less complex algebraically, and are closer to the solutions produced by human experts.

Physics problem solving is an important research area because the techniques used for solving physics problems, when fully developed, can aid teaching of physics and can be used for intelligent computer-aided engineering analysis and design.

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REFERENCES

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(THE LEFT END OF A BEAM IS SUPPORTED BY A SPRING WITH A CONSTANT OF 50 LB/FT)(THE SPRING MAKES AN ANGLE OF 70 DEGREES WITH THE HORIZONTAL, WHILE THE BEAM MAKES AN ANGLE OF 20 DEGREES WITH THE HORIZONTAL)(A BOY WEIGHING 50 LB STANDS AT THE RIGHT END OF THE BEAM, AND A WEIGHT OF 200 LB IS ATTACHED 2 FT FROM THE LEFT END)(THE BEAM IS SUPPORTED BY A ROPE WHICH MAKES AN ANGLE OF 120 DEGREES WITH THE HORIZONTAL)(THE ROPE IS ATTACHED 3 FT FROM THE RIGHT END)(HOW MUCH IS THE SPRING STRETCHED, AND WHAT IS THE LENGTH OF THE BEAM)

ANSWER: 3.263518 FT, 11.21168 FT

Figure 1: Example Problem and Solution