Proposal Status | MAIN ▶

Organization: University of Texas at El Paso

Review #3

Proposal Number:	0953339
NSF Program:	Numeric, Symbolic, and Algebraic Computation
Principal Investigator:	Ceberio, Martine C
Proposal Title:	CAREER: Symbolic-Numeric Constraint-Based Solutions for Real-World Scientific Problems
Rating:	Very Good

REVIEW:

What is the intellectual merit of the proposed activity?

The proposal presents a well-articulated research and educational project, centered around the principles of numerical constraint solving (specifically, NCS for continuous domains).

RESEARCH COMPONENT:
The research component nicely expands the previous work conducted by the PI (who is an established and recognized figure in the field of constraint programming). The three directions of development target enhancing propagation and precision (e.g., via new global constraints), exploring automated detection of soft constraints, and distributed constraint solving.
The reviewer was highly impressed by the proposed activities in the first two areas of development. The issue of global constraints in continuous domains (especially in the non-linear case) is a cutting-edge problem, whose resolution would have a profound impact on a more widespread use of NCS.
The area of soft-constraints is also quite novel, and it has great potential for applications (e.g., modeling preferences in reasoning agents).
I was less impressed by the proposed effort in distributed constraint solving; the effort seems to focus on adapting constraint solving to distributed architectures -- but there is no mention nor discussion of the large number of proposals that already exist in this area (e.g., recent work of van Hentenryck). The role of "networked social structures" is not discussed in the proposal and seems confusing.

EDUCATIONAL COMPONENT:
The proposal articulates a relatively standard, but well-designed, educational and outreach program, which includes new graduate and undergraduate classes and the development of a textbook. The idea of introducing constraint programming as a tool for teaching problem solving is intriguing - it may succeed or fail, but in either cases it is the kind of activity that is worth attempting. The connection with K-12 schools is also quite interesting, and the letters show serious commitment. I would have liked to see some more details on the specific activities conducted with grades 8-12 and perhaps how such activities fit in the (fairly rigid) structure of curricula and how they meet state standards.

OUTREACH COMPONENT:
The PI has already been an active participant in the several outreach activities within UTEP and in the El Paso area. She has a wealth of knowledge and a support infrastructure that will enable her to make an impact, broadening participation of Hispanic students and women to the area of computing. The link with CAHSI is also a nice addition, which will enable access to great resources and facilitate dissemination.

What are the broader impacts of the proposed activity?

The PI operates in a minority-serving institution, with a long (and successful) tradition of reaching out to a diverse student population. The activities (especially those associated to the EDUCATIONAL component of the project) are nicely integrated in the existing outreach initiatives, and they have the potential of

enhancing critical thinking and problem solving skills in a large number of students. This will create new generations of students with greater opportunities to access careers in STEM areas.
From the research perspective, the broader impact lies in the potential applications of NCS in real-world domains - an aspect that unfortunately is not properly emphasized in this proposal.

Summary Statement

Overall, this is a nice proposal. Its educational component is very strong and with great potential for broad impact. The research component is in part outstanding (first two research goals) and in part disappointing (third research goal). In spite of this, I believe that the first two research goals have such a strong potential and such a wide number of potential directions to be sufficient for the needs of this proposal.

◀ **Back to Proposal Status Detail**

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