



*Newsletter* - January 2002  
**ASME Central Iowa Section**

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## **JOINT SECTION MEETING – ASME/SAE**

### **Distinguished Lecturer – David A. Levinson**

Staff Aerospace Engineer - Lockheed Martin Advanced Technology Center

2 CEU Credits

Thursday, January 17 2002

Iowa State Memorial Union, Cardinal Room

Meeting Chair – Nosiru Ola (319)-292-8568

**Meal Choice (Chicken, Beef, or Ham)**

**Area contacts and individuals should forward their meal choices to Max Gassman. (515) 294-4587 or [mpg@iastate.edu](mailto:mpg@iastate.edu)**

<b>Schedule of Events</b>	<b>Costs</b>
<b>4:00 Seminar</b>	<b>Students Free</b>
<b>5:00 Social Hour</b>	<b>Members/Guest - \$15.00 ea.</b>
<b>6:00 Dinner</b>	
<b>7:00 Speaker</b>	

### **Distinguished Lecturer – David A. Levinson**

David A. Levinson holds the position of Staff Aerospace Engineer at the Lockheed Martin Advanced Technology Center in Palo Alto, California, where he is responsible for producing special purpose computer programs for predicting motions of complex mechanical systems. Over the years, he has been the recipient of numerous engineering awards, among them the American Institute of Aeronautics and Astronautics (AIAA) San Francisco Section Outstanding Young Engineer Award, the AIAA San Francisco Section Engineer of the Year Award in Astronautics, the AIAA San Francisco Section Engineering Educator of the Year Award, the ASME Santa Clara Valley Section Distinguished Mechanical Engineer Award, the American Astronautical Society Outstanding Achievement Award, and the Lockheed Missiles and Space Company President's Award. He is the author or co-author of 43 published technical papers, a co-author of the two McGraw-Hill textbooks, *Spacecraft Dynamics and Dynamics: Theory and Applications*, and a co-author of the desktop-published textbooks: *Dynamics Online: Theory and Implementation with AUTOLEV*, *Engineering Mechanics Online: Part I*, and *Engineering Mechanics Online: Part 2*. Mr. Levinson is a Fellow of both the American Astronautical Society (AAS) and ASME International, and is an Associate Fellow of the AIAA.

#### **4:00 PM: “Dynamics of Complex Systems” – David Levinson**

A crucial phase in the design of a complex mechanical system, such as a multibody spacecraft, a robotic device, or a mechanism, is the formulation of exact, nonlinear, differential equations of motion of the system for use in motion simulations and for linearization as a prelude to control system design. For complex systems such as these, the use of classical methods (e.g., Newton-Euler, Lagrange, etc.) for formulating the associated equations of motion requires so much labor and/or leads to such complicated equations that it becomes prohibitive.

In contrast, Kane's method for formulating equations of motion does not suffer from these shortcomings and, consequently, has become the industry standard. All of the best computer programs for dealing with the dynamics of complex multibody systems are based on this method. Moreover, Kane's method, the foundation of which rests on the simplest of kinematical ideas, is much easier to teach and to learn than the classical approaches, and, hence, has become a part of the mechanical engineering curriculum at a large number of major universities. Nevertheless, many engineering faculty members and students still are unfamiliar with Kane's method, possibly because the mechanics problems they encounter in academic work rarely possess the level of complexity that exposes the practical flaws inherent in the equation formulation methods these individuals employ.

It is the purpose of this talk to bring to light the practical shortcomings of the classical methods when applied to the task of formulating equations of motion of complex systems, and to give a brief overview of Kane's method. A computer program called AUTOLEV, employing symbol manipulation and particularly designed to solve mechanics problems, will be introduced. AUTOLEV is gaining popularity both as a tool in industry and as an aid in the teaching and learning of mechanics in university courses of instruction. AUTOLEV is ideal for use in conventional undergraduate vectorial mechanics courses in statics and dynamics, and is particularly well suited for more advanced dynamics courses based on Kane's method.

**7:00 PM: “The Amazing Effectiveness of the Mathematical Sciences” – David Levinson**

Undergraduate engineering students become exposed to the mathematical sciences through their course work in such subjects as statics, dynamics, mechanics of materials, electrical science, thermodynamics, and fluid mechanics. It is probably safe to say that in the frenzy of such necessary things as attending lectures, doing problem sets, completing laboratory assignments, and studying for exams, these students rarely find themselves reflecting on the amazing fact that the mathematical sciences they are studying are what permit engineers to predict correctly the behavior of newly designed engineering systems *before* these systems are built--feats of prognostication that would be regarded as magic in some quarters.

For example, since it is impractical to design by trial and error complex engineering systems, such as \$200 million spacecraft and aircraft, as one might do in connection with much less expensive vehicles, such as automobiles, the mathematical sciences are exploited to an unprecedented degree in the aerospace industry to create new flight vehicles that work as predicted the first time they are flown.

This talk is intended to instill an appreciation of the amazing effectiveness of the mathematical sciences in human endeavors. Mr. Levinson is in demand nationally and internationally as a speaker. He is well known for his unusual ability to explain complex ideas to general audiences in an informative and entertaining way. For over 20 years he has lectured on technical subjects to a wide variety of audiences, including Cub Scouts, engineering graduate students, swimming coaches, physicians, high school students, teachers, and fifth graders.

**Your ASME Central Iowa Section Officers**

**Chair**

**Garrett Goins 515-289-3534**

**E-mail: GoinsGarrettL@JohnDeere.com**

**Vice Chair**

**Glenn Anderkay 319-292-8716**

**E-mail: AnderkayGA@JohnDeere.com**

**Secretary and Public Relations**

**Mike Walker 515 225 8383**

**E-mail: mikew@iiiinc.com**

**E-mail: rmwalker14@aol.com**

**Past Chair**

**Todd Isaacson 319-292-8259**

**E-mail: IsaacsonToddA@JohnDeere.com**

**Member Interests**

**Nosiru Ola 319-292-8568**

**E-mail: OlaNosiruH@JohnDeere.com**

**Professional Development**

**Max Gassman 515-294-4587**

**E-mail: mpg@iastate.edu**

**Honors and Awards**

**Dennis Kinkaid 641-787-5273**

**E-mail: dkinka@maytag.com**

**Student Advisor**

**Francine Battaglia 515-294-2085**

**E-mail: francine@iastate.edu**

**Professional Ethics & Practice**

**Donald Wandling 515-232-0158**

**E-mail: wandling@ames.net**

**Membership Development**

**Glenn Anderkay 319-292-8716**

**E-mail: AnderkayGA@JohnDeere.com**

**ISU Students:**

***Chairs Corner***

I hope everyone had a relaxing holiday vacation and is ready for another year.

Many of you did not receive the Newsletter in time to make our November meeting. I sincerely apologize for the difficulties we incurred. If you receive a “scrambled” Newsletter via email call me at (515) 289-3534. We’ll establish a format that will meet your needs. I try to keep the membership roster current. If you are receiving the postal version, but not the electronic version via email, please send me your information at [goinsgarrettl@johndeere.com](mailto:goinsgarrettl@johndeere.com).

Thank you

***Garrett Goins***

**Central Iowa Chair**

**515-289-3534**

**Important Dates – Upcoming Events:**

**Jan 17 – Distinguished Lecture, Iowa State Memorial Union**

**David Levinson “The Amazing Effectiveness of the Mathematical Sciences”**

**Feb 18 – Distinguished Lecture, Iowa State Campus**

**Debra Long “Ethics”**

**March 12 – Tour of DeeZee Manufacturing in Ankeny Iowa.**

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