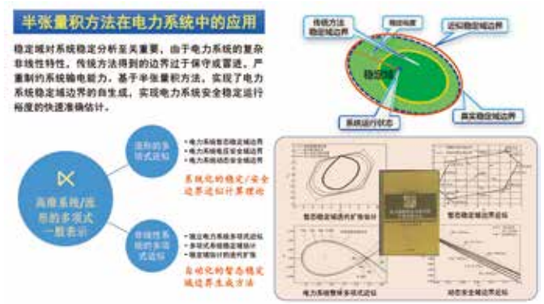
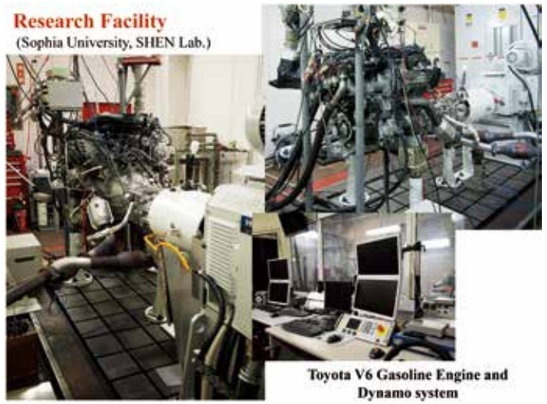
Cheng Daizhan, Academy of Mathematics and Systems Science, Chinese Academy of Sciences

Logical dynamic systems (LDSs) exist widely in the nature. But the short of efficient mathematical tool becomes a bottleneck for the analysis and control design of LDS. Using semi-tensor product (STP) of matrices proposed by Daizhan Cheng, he has developed an algebraic state-space representation for LDS, and solved two fundamental scientific problems: (i) how to analyze the dynamic behavior of logical networks? (ii) how to design efficient control for logical networks? As a result, he has established the control theory of LDS. The related works have not only received the national and international awards, but also stimulated many follow-up researches. Recently, this theory has been applied to the theoretical investigations in many fields. Furthermore, it has also been used to some engineering problems such as power systems, hybrid vehicle, etc. and demonstrated its potential wide applications. This is a new direction initiated independently and led the world development by Chinese scientist. It has significant importance.



清华大学卢强院士、梅生伟教授等将半张量积方法用于实际电力系统，成果显著，被相关专家称为“里程碑式的工作”

Professors Qiang Lu, Shengwei Mei et al. from Tsinghua University have applied the STP technique to practical power systems and achieved significant engineering improvement. It has been appreciated by a power system expert as “milestone work”



日本上智大学先进动力控制实验室申铁龙教授研究组利用逻辑系统的代数状态空间方法控制混合动力机车。实物仿真达到减排6%，省油3.57%的良好效果

At the Advance Powertrain Control Laboratory of Sophia University in Japan, Professor Tielong Shen’s group has used the algebraic state space approach of logical systems to hybrid vehicles. The real engine simulation shows that the new method can reduce 6% gas emission and save 3.75% oil

程代展因其“对非线性控制理论及其应用的贡献”于 2006 年入选国际电气与电子工程师协会 (IEEE) 会士

In 2006 Daizhan Cheng was elected to the Fellow of IEEE “for contributions to nonlinear control theory and its applications”

程代展因其“对非线性控制理论、控制的数值实现及其应用的贡献”于2008年入选国际自动控制联合会(IFAC)会士

In 2008 Daizhan Cheng was elected to the Fellow of IFAC “for contributions to nonlinear control theory, numerical realization of control, and their applications”

程代展
Cheng Daizhan

程代展

获奖个人所在单位：中国科学院数学与系统科学研究院

主要科技贡献：

逻辑动态系统在自然界中大量存在，但由于此前缺少有效的数学工具，使其分析与控制研究成为发展的瓶颈。程代展以其本人提出的矩阵半张量积为工具，发展了一套逻辑动态系统的代数状态空间方法，解决了 (1) 如何分析逻辑网络的动态行为；(2) 如何设计逻辑网络的有效控制，这两个关键科学问题，创立了逻辑动态系统的控制理论。相关工作不仅获得国家奖和国际奖，而且引发了国内外大量后续研究，形成控制论中的一个新方向。目前，该理论已被应用于众多领域的研究，并在电力系统及混合动力汽车控制等工程项目中得到初步应用，显示了其广阔的应用前景。这是由中国科学家独立开辟的新方向，并在国际上引领了该方向的发展潮流，具有重大意义。

逻辑系统的控制理论

Control Theory of Logical Dynamic Systems

其他应用研究

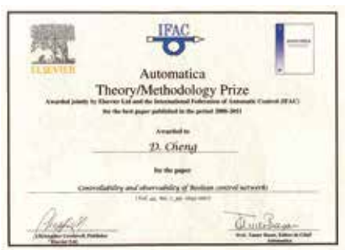
Other Applications

程代展和他的学生洪奕光、席在荣、王玉振“复杂非线性系统镇定控制的理论与设计”项目获2008年国家自然科学二等奖

The project “Stabilization theory and design of complex nonlinear systems” completed by Daizhan Cheng and his students Yiguang Hong, Zairong Xi, Yuzhen Wang received the second grade of National Natural Science Award of China in 2008

程代展和他的学生齐洪胜“逻辑动态系统控制的代数状态空间方法”项目获2014年国家自然科学二等奖

The project “Algebraic state space approach to logical dynamic control systems” completed by Daizhan Cheng and his student Hongsheng Qi received the second grade of National Natural Science Award of China again in 2014



2011 年程代展获国际自动控制联合会 (IFAC) 颁发的其旗舰杂志 Automatica 2008-2010 理论 / 方法类最佳论文奖。该论文是迄今为止唯一一篇由中国作者完成的

Daizhan Cheng received the 2008-2010 Best Paper Award issued by IFAC for its flagship journal Automatica in 2011. This paper is the only awarded one completed by Chinese scholars so far