The first National Conference on Multidisciplinary, Design, Analysis, and Optimization (NC-MDAO) was held in Mechanical Engineering, Indian Institute of Science-Bengaluru, during March 23-24, 2017. This conference was jointly conducted by Indian Institute of Science, Indian Institute of Technology Madras, and the Design Division of the Aeronautical Society of India. The conference brought together researchers and industry professionals working in the areas of MDAO. Established techniques and emerging technologies were presented in the conference to take advantage of the past accomplishments and to step up the future of optimization-based design and model-based systems.

The conference consisted of three keynote talks, four invited talks, three industry presentations, a session on emerging trends in the field, and a panel discussion in addition to oral presentations of contributed papers. About 100 registered participants attended the conference. Notable attendees included several leaders from the industry, distinguished engineers and technocrats from government research laboratories, and experience academicians. A three-member team from German Aerospace, DLR, attended the conference. Dr. Somanath Nagendra of Pratt and Whitney, USA, represented US industry as well as the premier journal of the field, Structural and Multidisciplinary Optimization.

The conference began with a welcome by the Conference Chair, Prof. G. K. Ananthasuresh who gave the background to the conference. Three workshops and a brainstorming session had preceded this conference in the last three years. They were coordinated by Prof. Ananthasuresh, Prof. Palaniappan Ramu (IIT Madras), Dr. Ravi Salagame (Aptiv Technologies), and Vinay Ramanath (Siemens). The brainstorming session was attended by Dr. Kota Harinarayana and Dr. A. R. Upadhya among other dignitaries and stakeholders of MDAO in India.

Prof. Palaniappan Ramu, the co-chair of the conference, briefed the audience on the technical programme of the conference and urged all to keep to the time-limit. Conference Patron, Dr. Kota Harinarayana, highlighted the importance of MDAO in Indian industry and for the success of many a government mission. He also introduced the connection between DLR and India; he introduced the first keynote speaker, Mr. Bjoern Nagel of DLR, Germany.

In Session 1A, Mr. Nagel, in his keynote lecture, gave an overview of the design and development process of aerospace components and systems. He emphasized the multi-team and multi-institutional framework followed in Germany to meet the challenges of aeronautical design. He described how climate scientists and aero-engineers worked together to not only mitigate the effect of aircraft on atmosphere but also increase fuel-efficiency by identifying the optimum height at which aircraft ought to fly.

In Session 1B, chaired by Dr. Ravi Salagame (Aptiv), there was an invited talk by Dr. Somanath Nagendra (who talked about how deep learning could be used in multidisciplinary design) and four contributed papers. Sessions 1C1 and 1C2 were parallel sessions and were chaired by Mr. Prajwal Shivaprakasha (DLR) and Prof. Saravana Kumar (IIT Madras). In Session 1D, Dr. Pankaj Priyadarshi (VSSC, Trivandrum), in his keynote talk, eloquently described MDO opportunities in space vehicle design. He talked about multifidelity approach to spacecraft design. This was followed by an invited talk by Dr. Anutosh Moitra who presented the industry perspective on aircraft design. Sessions 1E1 and 1E2 were parallel sessions chaired by Prof. Palaniappan Ramu and Dr. Raghavan (Cyient Ltd). Day 1 of the conference ended with a presentation by ESTECO/Altem Technologies who sponsored the conference, followed by three presentations on emerging trends by Prof. Palaniappan Ramu, Dr. Somanath Nagendra, and Prof. G. K. Ananthasuresh. A conference banquet was arranged at the IISc Jawahar Guesthouse.

Session 2A of Day 2 of the conference started with a keynote talk by Mr. Brian McMurray of General Motors-India. He described the importance of creativity and design thinking in automobile design and talked about future of automobile industry including self-driving cars and automated highways. In his invited talk, Dr. Madhusudan (ADA-Bengaluru) gave a detailed talk on active aeroelastic wing technology. In this session, 2B, chaired by eminent academician Prof. Sudhakar (formerly with IIT Bombay), there were four other talks. Session 2C1 and 2C2 were parallel sessions and were chaired by Dr. Ravi Salagame and Dr. M. Sivapragasam (M. S. Ramaiah University of Applied Sciences). Session 2D included a presentation by Autodesk, a sponsor of the conference, followed by an invited talk by Dr. Shivaprakasha of DLR. There were also presentations by two sponsors, MSC and Autodesk. Sessions 1E1 and 1E2 were parallel sessions chaired by Dr. D. V. T. G. Pavan Kumar (NAL) and Prof. Dhish Saxena (IIT Roorkee).

The last session of the conference was a Panel Discussion moderated by Prof. K. Sudhakar (formerly IIT Bombay) and Dr. Ravi Salagame (Aptiv) with panel members: Dr. AR. Upadhya (NAL), Joachim Szodruch (DLR), Murali Balasubramanian (Fiat Chrysler Automotive), Suresh Nagarowth (Cyient). The panel discussed an important

topic of the field: how to institutionalize optimization in the Indian industry. Many interesting points were made in the discussion with active participation from the audience.

Springer publishing company has sponsored the best student paper award at the conference. Mr. Padmanabha Prasanna Simha, an undergraduate student from IIST-Thiruvananthapuram, was recognized with the Springer Best Student Paper award for this presentation entitled "Low Thrust Interplanetary Mission Trajectory Optimization using Differential Evolution".

After the conference participants left, a team of the organizers of the conference, DLR team, and other distinguished guests met for about 30 min to discuss the follow-up on matters presented and discussed during the conference. A discussion over dinner at Sheraton Hotel, Yashwanthpur, formally ended the conference.

It was observed that there is a lot of enthusiasm in the Indian industry for MDAO activities. There is much to gain by government laboratories, academia, and industry to work together in this domain. The following four follow-up items transpired:

1. It was decided that this conference should become an annual event with special meetings in between.
2. Resuming a special interest group comprising all stakeholders is thought to be a good idea.
3. A consortium of industry leaders is to be formed to formalize academia-industry-government collaboration wherein common research and translational challenges could be addressed.
4. Making a representation to DST/SERB to release a call for MDAO in India will be pursued too.

Additionally, feedback was sought from conference participants using a form that has specific questions about the conference experience. There were constructive suggestions and positive feedback about the conference overall.

In summary, this first conference on MDAO turned to be bigger and better that what the organizers had envisaged. The enthusiastic participation of all confirmed that MDAO is a good field for India to focus on. The aforementioned four items will be followed up in the coming months, which might lead to other activities to grow this area in India and to connect India with other countries that are forerunners in this area.