Standardization Newsletter

Standardisation Efforts on Industrial and Service Robots

As the market for service robots is growing constantly, the demand for standards in this area rises. In order to bring a robotic product on the market, manufacturers have to fulfil safety regulations. Apart from existing general (type A and type B) safety standards, product specific (type C) safety standards are of great value to manufacturers as they ease hazard analysis and also reduce the legal risk for research facilities and companies. To satisfy this demand, the international standardisation organisation (ISO) has been developing safety standards in the domain of industrial robots for many years.

About 8 years ago, the importance of the emerging sector of service robots has been realized and first working groups were established to deal with these robots. As a result the first safety standard for "personal care robots" – service robots in direct interaction with a human – has been published in February 2014.

While safety standards form the basis to establish a robotic product on the market, other standards can help to reduce trade barriers and to foster market growth. Standards on terminology and coordinate systems improve communication between manufacturers, suppliers and end users and are a first step towards exchangeable robot components. In a few years more standards on robot modularity can be expected that will help to make robot systems modular and highly interchangeable. Further initiatives have started to create standards for benchmarking robot performance, making complex robot abilities measurable with the goal to increase market transparency.
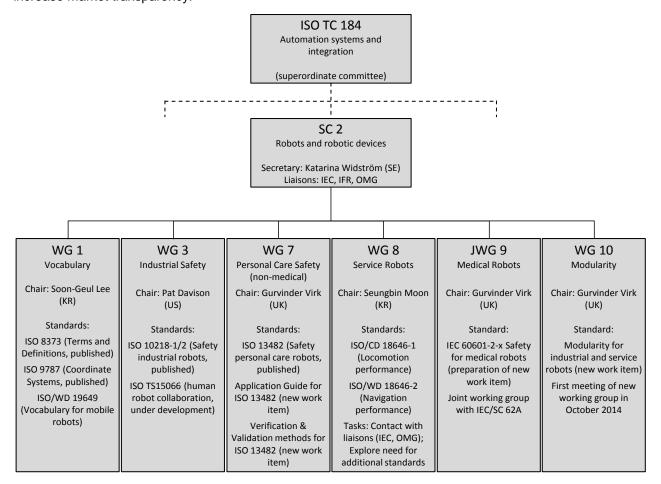

Fig. 1 Structure of ISO TC184/SC 2

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All ISO standardisation related to robots takes place in committee TC 184/SC 2 (robots and robotic devices), which is currently organized in six working groups (see figure 1). Standards are developed through the instrument of "commenting": During balloting periods, each national standardization organization has the possibility to submit comments proposing to change, delete or add text to the respective standard. In the international meetings these comments are resolved in discussions and agreed changes are applied to the document.

Nations that are currently actively participating in developing these standards are China, France, Germany, the Netherlands, Japan, Korea, United Kingdom and the United States. The working groups usually meet three times a year, in turns in the US, Europe and Asia. Meetings of the SC 2 committee are held every one and a half years. Working groups are open for all motivated contributors. Experts are explicitly encouraged to participate.[1]

Further information is available on the ISO Website[2] and the committee website[3].

Progress in WG 1 – Vocabulary and coordinate systems

Chair: Soon-Geul Lee (Korea)
Standards:
- ISO 8373 – Robots and robotic devices – Vocabulary (published)
- ISO 9787 – Robots and robotic devices – Coordinate systems and motion nomenclatures (published)
- ISO/WD 19649 – Robots and robotic devices – Vocabulary for mobile robots (working draft)

In the standard ISO 8373 published in 2012, WG 1 adopted definitions that were formerly tailored to industrial robot applications so that they can be applied to the service robot domain as well. Examples are the definitions of "robot" or "autonomy". In addition an existing standard on Coordinate Systems for industrial robots ISO 9787 was revised and extended by Coordinate Systems for mobile service robots.

Currently the standard ISO 19649 containing terms and definitions in the field of robot mobility is in preparation which will comprise vocabulary for wheeled, tracked and legged mobile service robots. Further standards dealing, for instance, with terminology for other main skills of a service robot such as perception or navigation and planning may follow in the next years.

Progress in WG 3 – Industrial safety

Chair: Pat Davison (USA)
Standards:
- ISO 10218-1 – Robots for industrial environments – Safety requirements – Part 1: Robot (published in 2011)
- ISO 10218-2 – Robots for industrial environments – Safety requirements – Part 1: Industrial robot system and integration (published in 2011)
- ISO/TS 15066 – Robots and robotic devices -- Safety requirements for industrial robots -- Collaborative operation (under elaboration)

In WG 3 work on the technical specification ISO/TS 15066 continued. The technical specification contains limits for impact forces and pressures which might lead to an injury in case of collisions. Values are taken from medical literature/forensics as well as from practical tests on pain tolerance levels.

Currently study groups inside WG 3 are actively working on fine-tuning the content of the ISO/DTS 15066 to finalize a first version of the Technical Specification by the end of this year. One of the foci is on

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implementing a coordinated procedure on how to deal with possible contact situations during human-robot-collaboration and to provide first thresholds for a safe implementation in such operations.

In parallel to the next WG3 committee meeting in London a first gathering of experts is scheduled from a new Study Group on safety data for human-machine interactions (ISO TC/199) with additional participants from the WG3 experts.

Progress in WG 7 – Personal Care Safety

Chair: Gurvinder Virk (UK)
Standards:
- ISO 13482 – Robots and robotic devices – Safety requirements for personal care robots (published in February 2014)
- Application guide for ISO 13482 to be published as a technical report (new work item)
- Validation criteria for personal care robots (new work item)

After five years development time, ISO 13482, the first safety standard for "personal care robots" has finally been published in February 2014. Parallel balloting is also underway to harmonize the ISO 13482 safety standard under the European Machinery Directive[4]. With the publication of ISO13482 manufacturers can for the first time rely on a specialized type C safety standard when designing their products.

Currently WG 7 is working on additional standardisation items related to personal care robot safety. In the next years criteria for verification and validation of personal care robot safety will be developed and published in a technical specification. In addition, the publication of a guide to ISO 13482 is planned with examples on how to perform risk assessment for autonomous mobile robots.

Progress in WG 8 – Service robots

Chair: Seungbin Moon (Korea)
Task: Determine need for additional standards for service robots
Standards:
- ISO/CD 18646-1 – Robots and robotic devices - Performance criteria and related test methods for service robot – Part 1: Locomotion for wheeled robot
- ISO/WD 18646-2 – Robots and robotic devices - Performance criteria and related test methods for service robot – Part 2: Navigation

Service robots are complex products with a large number of functions. In order to compare the performance of functions like path-finding, object recognition or the ability to move on difficult terrain, standardized test methods are necessary. One year ago, WG 8 started the development of ISO 18646-1, a standard for measuring locomotion performance. The current early draft includes instructions to measure speed, braking distance, climbing ability, etc. Further material will be added in the future. In addition, the work on a second part on navigation performance has recently been started.

Progress in JWG 9 – Medical robot safety

Chair: Gurvinder Virk (UK)
Standard: IEC 60601-2-x (Evaluation of new work item)

JWG 9 is a Joint Working Group in cooperation with IEC/SC 62A. In the last years, initial concepts have been discussed, e.g. the definition of autonomy will be the foundation for a future safety standard for medical robots. Recently several study groups have been founded inside JWG 9 with the focus on more specific domains such as rehabilitation and surgical robots.

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[4] Directive 2006/42/EC on machinery; http://ec.europa.eu/enterprise/sectors/mechanical/documents/legislation/machinery/index_en.htm

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Progress in WG 10 – Modularity

Chair: Gurvinder Virk (UK)
Standard: Modularity for industrial and service robots (new work item)

Although the number of service robot installation is constantly growing, reusability of software and hardware components as well as interchangeability of parts is considered as relatively low. A significant challenge for standardisation in the next years will be to establish a common bases for compatibility between hard- and software components from different manufacturers and the seamless exchange of parts or modules. This can only be reached, if mechanical, electrical and software interfaces are suitably taken into account.

For the last two years, a study group inside WG 8 has been responsible for exploring the possibility to develop a standard on robot modularity. In discussions with other working groups but also on workshops in parallel to big international robotic conferences, expectations and needs of academia and industry had been identified. As a result, ISO established a new working group WG 10, which will have its constitutional meeting in October 2014 and will then be responsible for developing a standard on robot modularity.

Possibilities to get involved in standardization work

For the European academia/research and industry it is crucial to participate in all standardization working groups with a sufficient number of technical experts. Only by doing so, innovations and products will be considered during the standardization process and latest research results can be incorporated in the standard. So we kindly ask you to consider participating in the standardization process!

Encouragement to attend international meetings

Technical experts, who attend international meetings, vote in international balloting procedures and submit comments to propose changes in the documents are appointed by the national standardization organization of their respective country. In order to get nominated, interested persons from industry or research institutes should contact their national standardization body to ask for details. Apart from formal contribution as a technical expert, it is also possible to visit a meeting as an observer. We encourage you to make use of this possibility.

Observers are also formally appointed by national standardization organizations, but do not have the right to participate in official balloting.

The next international meetings are planned as follows:

- October 20-24, 2014: Meetings of WG 1, 7, 8 and 10 in Osaka, Japan

- November 3-5, 2014: Meeting of WG 3 in London, UK

- January 19-21, 2015: Meetings of WG 3 in Orlando, USA

- February 2-6, 2015: Meetings of WG 1, 7, 8 and 10 in Jeju, Korea

- June 10-19, 2015: Meetings of WG 1, 3, 7, 8 and 10 as well as plenary meeting of SC2 in Frankfurt, Germany

Contributing to national mirror committees

When several experts from one country participate in standardisation, a national mirror committee may be formed. In these national committees homework and comments for the international meetings are coordinated and results from the international meetings are disseminated to the national community. Even if no mirror committee has been formed yet, it is possible for interested technical experts to contribute to standardization on a national level without attending the international meetings, for example by making comments for an international balloting.

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Benefit from travel cost subvention

The EU-funded coordination action RockEU offers the possibility to reimburse travel costs (within certain limits) to meetings for interested first-time visitors from a European country. If you are interested to join an international meeting, please contact Theo Jacobs (theo.jacobs@ipa.fraunhofer.de). It is obvious that only a long term engagement in these standardization efforts is beneficial for the WG or the participants.

European Topic Group on Standardisation

With the euRobotics aisbl "Topic Groups" is a community-driven instrument to coordinate the activities in specific sub-domains of robotics. The objective of a Topic Group is to support the launch of tangible "project proposals" by members of the European robotics community (be they member of euRobotics AISBL or not), but, first and foremost, to prepare the roadmap and project Calls that precede such proposals.[5]

In 2014, a topic group on standardisation was created which deals with standardisation activities in ISO, IEC and other standardisation organisations. A focus lies on research activities to support standardisation, e.g. to provide experimental data which can be included in standards or can be used to validate the requirements in standards. The standardisation topic group is headed by Gurvinder Virk and Paolo Barattini.[6]

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[5] Topic Groups: http://www.eu-robotics.net/ppp/objectives-of-our-topic-groups/

[6] List of euRobotics Topic Groups (as of 23 Juli 2014): http://www.eu-robotics.net/cms/upload/List_of_Topic_Groups_23072014.pdf