240AR057 - Human Robot Interaction & Teleoperation

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control
Academic year: 2017
Degree: MASTER'S DEGREE IN AUTOMATIC CONTROL AND ROBOTICS (Syllabus 2012). (Teaching unit Optional)
ECTS credits: 4,5
Teaching languages: English

Teaching staff
Coordinator: Pere Ponsa Asensio
Human centred design: http://www.epsevg.upc.edu/hcd
Others: Pere Ponsa
Alicia Casals

Prior skills
Skills and knowledge in control theory, robotics, dynamic model, simulation with MATLAB and SIMULINK.

Degree competences to which the subject contributes

Specific:
1. The student will be able to analyze and determine the kinematic and dynamic models of robots and control systems design motion and strength.
2. The student will be able to identify, obtain models, simulations, analyze and validate simple dynamic systems in adequate representation for the intended purpose (analysis, simulation and design).

General:
3. Ability to conduct research, development and innovation in the field of systems engineering, control and robotics, and as to direct the development of engineering solutions in new or unfamiliar environments, linking creativity, innovation and transfer of technology
4. Have adequate mathematical skills, analytical, scientific, instrumental, technological, and management information.

Teaching methodology
Teaching lessons in class
Project based Learning

Learning objectives of the subject
By the end of the course, the student will have achieved the following skills and knowledge:
Understand the components of a teleoperation system
Application of qualitative and quantitative methods.
Developing of technological solutions
Modeling the interaction between humans and automation
Interface design of human-automation systems
Performance criteria and metrics.
Ergonomic interaction in human automation systems
Understand the best control strategies
### Study load

<table>
<thead>
<tr>
<th>Total learning time: 112h 30m</th>
<th>Hours medium group: 20h 15m</th>
<th>18.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours small group: 20h 15m</td>
<td></td>
<td>18.00%</td>
</tr>
<tr>
<td>Self study: 72h</td>
<td></td>
<td>64.00%</td>
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</tbody>
</table>
# 240AR057 - Human Robot Interaction & Teleoperation

<table>
<thead>
<tr>
<th>Content</th>
<th>Teleoperation</th>
<th>Design and Evaluation of Interfaces</th>
<th>Human factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Related activities:</strong></td>
<td>Relate the components of a teleoperation system. The concepts and schemes are evaluated within the written test. Exercises of bilateral control with feedback force Joystick and Matlab SIMULINK (3D Animation).</td>
<td>Report and oral presentation: Kinect sensor applied in robotic systems.</td>
<td>Knowledge evaluated in the written test.</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td>Understand what is a teleoperation system and recognize the most important elements and the relationship between them.</td>
<td>Know the element that allow the conversation between the human and the system.</td>
<td>Understand the relevance of human factors inside human-automation interaction.</td>
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<tr>
<td><strong>Learning time:</strong></td>
<td>2h</td>
<td>13h 20m</td>
<td>2h</td>
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<tr>
<td></td>
<td>Guided activities: 2h</td>
<td>Guided activities: 5h</td>
<td>Guided activities: 2h</td>
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<tr>
<td></td>
<td>Self study : 8h 20m</td>
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# 240AR057 - Human Robot Interaction & Teleoperation

| **Haptic interaction** | **Learning time:** 13h 20m  
Guided activities: 5h  
Self study: 8h 20m |
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Definition of haptics. Standards and haptips guideline design. Haptic feedback.</td>
</tr>
<tr>
<td><strong>Related activities:</strong></td>
<td>Knowledge evaluated inside the written test. Practicum activities with Phantom interface.</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td>Learn the value of haptic/tactil channel in telerobotics.</td>
</tr>
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</table>

| **Human Automation structures** | **Learning time:** 2h  
Theory classes: 2h |
<table>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Human in the loop. Levels of automation. Traded control. Shared control. Human supervisory control.</td>
</tr>
<tr>
<td><strong>Related activities:</strong></td>
<td>Knowledge evaluated inside the written test.</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td>Recognize the control architectures.</td>
</tr>
</tbody>
</table>

| **Fields of application** | **Learning time:** 2h  
Theory classes: 2h |
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Argonne Laboratory. Medical surgery, underwater robotics systems. Unmmaned aerial vehicles.</td>
</tr>
<tr>
<td><strong>Related activities:</strong></td>
<td>Link between introduction and fields, evaluated in the written test.</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td>Understand the fields of application in teleoperation systems.</td>
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## Qualification system

Written test Pere: 30%  
Report Pere: 20%  
Written test Alicia: 30%  
Laboratory practice Alicia: 20%
Bibliography

Basic:


Complementary:
