1. Aims and Scope

Humanoid robot is a robot resembling the human body in terms of body shape. Humanoid robots, in general, have a body comprising of one head, two arms and two feet; however, some of them can only model a part of the body like upper body. Humanoid robots are autonomous because they can adapt to the changes around their environment or within themselves and keep reaching their targets. Humanoid robots are created to imitate the daily functions, both physical and mental, of the humans. Many scientists and experts from various disciplines including engineering, cognitive science and linguistics combined their endeavours to create a robot, resembling humans as much as possible. The objective of those creators with respect to these robots is to understand human mind and intelligence and ensure that they move like humans.

The recent theoretical developments in the area of fuzzy sets provide novel perspectives for the key mechanisms of decision making and information processing in humanoid robot systems. Besides, the environmental data should be comprehensively analysed to help the robot take necessary decisions with regard to its position or other movements. Fuzzy logic system module is used for the artificial intelligence control algorithm of the robot. This module is responsible for the stability and balance of the robot during its movements such as walking and kicking. The implementation of the fuzzy logic is included in the adjustable and changeable microcontroller software. Because the application is in the software, this procedure is processed in the microcontroller where input values are taken from the slope sensor and output values provide accurate locations for the servomotors.

Fuzzy logic is a problem-solving control system methodology which imitates the way people reach a solution based on uncertain, ambiguous, noisy and missed input information. Besides, fuzzy logic system can use all input and output data needed in processing. The key idea with the fuzzy logic is that inputs are taken from sensors having a certain value and transformed into membership values varying from 0 to 1. Afterwards, membership values generated go into fuzzy logic process by using a set of rules. In the previous process, the system obtains a fuzzy set to be transformed into exact values. Fuzzy logic systems can process incorrect values and generate acceptable outputs. Besides, there is no need for highly complex mathematical computations to control the robot.

Ordinary fuzzy sets introduced by Zadeh (1965) have been later extended to type-2 fuzzy sets, intuitionistic fuzzy sets, hesitant fuzzy sets, and neutrosophic fuzzy sets. All these new extensions aim at better defining membership functions together with experts’ hesitancy degrees. They focus on imitating the human’s thinking style in the decision making processes. These new extensions can be used for making better inferences and thus modelling the behaviours of humanoid robots similar to human beings. Fuzzy control theory can be enriched by the use of the new extensions.

The aim of this special issue is to examine the problems and limitations discussed above with the help of ordinary fuzzy sets and their extensions. The physical design of a robot does not need to be very accurate and complex as it can offset those problems. Since fuzzy logic is implemented with software, the adjustments in the system can be done in an easier and cheaper way and do not need extra space. Furthermore, due to a fuzzy approach, the robots have the capability to use data which is not well defined in an efficient and productive way.

This special issue includes the recent developments and the theories associated with fuzzy set models. Target audience includes both academics and practitioners from the industry having an interest in the theory and practice of those models. Papers for the special issue are invited on but not limited to any of the topics listed below.

2. Topics Covered

The topics include but are not limited to:
### Theoretical methods

- Fuzzy control theory through extensions of ordinary fuzzy sets
- Fuzzy Omnidirectional controller for the humanoid soccer robot
- Fuzzy logic in Robotic manipulators for control of mobile robot
- Gait control of humanoid robots via fuzzy logic (Energy-efficiency optimization problem)
- Fuzzy systems for humanoid balance control
- Fuzzy controller for navigation and obstacle avoidance on mobile robots
- Fuzzy logic in path planning performing local and global navigation
- Fuzzy logic controller for trajectory tracking of a wheeled mobile robot using Taguchi method
- Fuzzy controllers for intelligent vehicles path tracking
- Fuzzy behaviour system for navigating robotic vehicles
- Fuzzy control of the smart tennis chair using pressure sensors and omnidirectional wheels
- Different fuzzy logic controllers are developed using Zero-order Sugeno model for the mobile robot navigation
- Fuzzy Controller is applied in Obstacle Avoiding

### Application areas

- Energy-efficiency optimization
- Balance Control
- Path Planning
- Steering Control
- Rate control
- Process Modelling
- Process Control
- Decision Making

### 3. Submission Guidelines


It is essential that your manuscript is identified as a Special Issue contribution:

- Ensure you choose ‘Special Issue’ when submitting.
- A cover letter must be included which includes the title ‘Special Issue on Toward Humanoid Robots: Fuzzy Sets and Extensions’

### 4. Important Dates

- **31 May 2019**: Submission deadline
- **July 2019**: notification of first round of reviews
- **September 2019**: revised submissions due for guidance only
- **November 2019**: final notice of acceptance/rejection

### 5. GUEST EDITORS

Prof Cengiz Kahraman
University of Istanbul Technical, Turkey
Email: kahramanc@itu.edu.tr

Dr. Muhammet Deveci
University of Nottingham, UK
Email: muhammet.deveci@nottingham.ac.uk; muhammetdeveci@gmail.com

Dr. Seda Türk
Igdir University, Turkey
Email: seda.ozdemir@igdir.edu.tr