

## “SUMO” CONTEST RULES

*Version 3.5 dated June 13, 2016*  
*According to the version of the Open Robotics tournament*  
*for the Polytechnical Museum Cup.*  
*The regulation is based on the rules of [RobotChallenge](#).*

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## Introduction

The "SUMO" new rules are based on the rules of the European RobotChallenge Sumo games. The main objective of the new rules is to facilitate the participants the participation in Sumo international competitions.

The main differences from RobotChallenge rules:

1. Match is held not in 3 minutes, but in three rounds of 90 seconds.
2. It is not necessary that the robot has IR start system. The participants who wish to participate in European competitions on Sumo at the RobotChallenge should take care of installing it themselves.
3. There is no separate class for Lego robots.

### 1. Definition of a sumo match

Match is played between two teams. Each team has one or more participants. Only one team member may approach the ring, others should watch from the auditory. In accordance with the rules of the game (hereinafter referred to as "these rules"), each team puts the robot on the ring, which was built by the team according to the requirements in section 2. Match starts with the referee command and continues until the team gains two points. The referee determines the winner of the match.

### 2. Requirements to robots

#### 2.1. General requirements to robots

- 2.1.1. The following requirements apply to all robots. Additional requirements for Humanoid Sumo robots see in section 3.2.
- 2.1.2. The robot must fit freely in a square box corresponding to its class sizes (see table 1). When box placed over the robot is being lifted up robot must not lift up the ring surface.
- 2.1.3. The total weight of the robot at the start of the match should be less than the weight limit for its class (see table 1).
- 2.1.4. The robot can grow in size after the start of the match, but should not be physically divided into parts, and must be one whole robot. Robots that violate these prohibitions, loses the match. Screws, nuts, and other parts of the robot with a total mass of not more than 5 g, that fall out of the robot does not lead to the loose of the match.
- 2.1.5. All robots must be autonomous. Any control mechanisms are allowed if all their components are on the robot and the mechanism do not interact with an external control system (man, machine etc.).
- 2.1.6. Each robot gets a number at registration. Participants should display this number on the robot in order for spectators and organizers recognize their robot.

Table 1. Table of restrictions on the size and weight

Class	Height	Width	Length	Weight
Mini Sumo 10x10	Unlimited	10 cm	10 cm	500 g
Mini Sumo 15x15	Unlimited	15 cm	15 cm	1,000 g
Humanoids	50 cm	20 cm	20 cm	3,000 g
Micro Sumo 5x5	5 cm	5 cm	5 cm	100 g

## 2.2. Requirements to the humanoid sumo robot

- 2.2.1. Robot should be bipedal walking humanoid, which shifts its center of gravity to maintain balance while walking.
- 2.2.2. While walking one leg should rise from the floor, while the other hold the robot balanced.
- 2.2.3. While walking leg of the robot that is balancing in the air should be flexed at the knee of no less than 90 degrees. If this is not the case, the robot is not considered to be walking.
- 2.2.4. The foot can be of any shape as long as the following conditions are met:
  - 2.2.4.1. Foot of the robot is defined as the part of a robot contacting with the surface of the arena (ground)
  - 2.2.4.2. Maximum length (size) of the foot should be less than 50% of an outstretched leg of the robot. Leg length is defined as the distance between the place where the robot foot touches the ground and axis, linking up the leg with the corpus of the robot.
  - 2.2.4.3. The maximum length of the foot must be less than 20 cm.
- 2.2.5. When the robot stands or walks, rectangles circumscribed around the left and right foot should not intersect.
- 2.2.6. The robot should have 2 hands. Every hand in the outstretched position should not exceed the length of the outstretched leg.
- 2.2.7. Robot should have the head.

## 2.3. Robot restrictions

- 2.3.1. It is prohibited to use sources of interference, such as IR-LEDs, designed to blind the infrared sensors of the opponent.
- 2.3.2. Parts that might break or damage the ring are prohibited. Do not use parts that harm the opponent robot or its owner. The usual jolts and bumps are not regarded as causing damage.
- 2.3.3. It is prohibited to use devices that can store liquid, powder, gas or other substances in order to blow off them toward the opponent.
- 2.3.4. Any flammable devices are prohibited.
- 2.3.5. Devices, throwing objects at the opponent are prohibited.

- 2.3.6. Sticky substances to improve adhesion are prohibited. Tires and other robot features that come in contact with the ring, should not be able to raise and retain a standard A4 sheet (density of 80 g/m<sup>2</sup>) for more than 2 seconds.
- 2.3.7. Devices increasing down force (such as vacuum pumps or magnets) are prohibited in all classes.
- 2.3.8. No edges of the robot including front bucket must be sharp enough to scratch or damage the ring, other robots or players. In general, the edges with a radius of more than 0.1 mm can be made of blunt 0.2 mm thick metal strip are satisfactory. The referees and organizers may demand that edges that are, in their opinion, too sharp, be covered with adhesive tape.

## 2.4. Modifications of the robot

- 2.4.1. Participants have the right to prompt meaningful robot modification between rounds and matches (including repair, replacement batteries, etc.), if the changes do not conflict with the design requirements of the robot and do not violate the competition rules.

## 2.5. Additional restrictions

- 2.5.1. Construction of a robot taking a part in the “Mini-sumo 15x15” class must not contain any kind of exposed metal elements (except of batteries or other kind of power sources). Metal element is considered to be exposed if it may possibly directly touch the rival robot or if this touching is possible through the layer of the flexible material of 2 mm thickness. The material is considered to be flexible if the sag of the material sample of length 5 cm is greater than 1 mm.

## 3. Requirements to the sumo ring

### 3.1. Inner ring area

- 3.1.1. Inner ring area is defined as the playing surface, surrounded by a white line, including it. Everything outside is considered the outer area of the ring.

### 3.2. Requirements to the ring

- 3.2.1. The ring should be of round shape and of sizes corresponding to the class.
- 3.2.2. The border is marked by a white line around the edge of the playing surface with the width of the corresponding class (see table 2). Inner ring area extends to the outer edge of that line. The ring is made of wooden material.
- 3.2.3. It is 5% deviation possible for all sizes specified in table 2.

### 3.3. Outer ring area

- 3.3.1. Around the ring it should be free space defined for each class. It can be of any color, shape and material, if basics of these rules are not violated. This space with the ring in the center is hereafter referred to as "the ring area". Any markings or parts of the platform with the ring beyond the minimum sizes will also be considered to be in the ring area.

Table 2. Ring settings

Class	Height	Diameter	Width borders	Minimum external space
Mini Sumo	2.5 cm	77 cm	2.5 cm	50 cm
Humanoids	5 cm	154 cm	5 cm	100 cm
Micro Sumo	1.25 cm	38.5 cm	1.25 cm	25 cm

## 4. Order of the match

### 4.1. Placement of the robots

- 4.1.1. With the referees command two teams come to the ring to place their robots on it.
- 4.1.2. The ring is divided into 4 quadrants (see fig. 1). Robots should be always placed in two opposing quadrants.
- 4.1.3. Each robot should be located on the border of the field within the correspondent quadrant. The robot has to cover the border, at least partially.
- 4.1.4. Robots are not to be moved after the placement is completed.

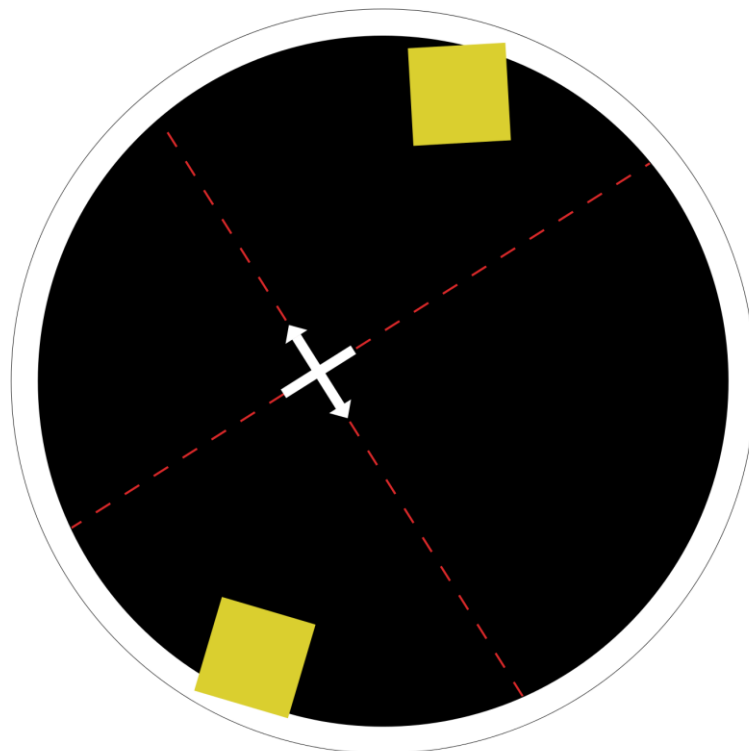


Fig. 1. Placement of the robots

## 4.2. Start

- 4.2.1. When using an IR receiver, the referee begins each round by sending a start signal from an IR transmitter. The robot having received the signal, the round begins immediately, without any delay. Technical parameters of the IR-receiver are given in the annex. Participants may use their own or ready modules offered by the organizers.
- 4.2.2. Without the use of an IR receiver, the referee announces the start of the round. Commands start robots and they can act after a five-second pause. During these five seconds the players must leave the ring area.

## 4.3. Stop and resume of the match

- 4.3.1. Match is stopped and resumed with the referees announcement.

## 4.4. Sumo matches procedure

- 4.4.1. One match is up to 3 rounds, each round lasts up to 90 seconds. By the referee's decision, the match may be prolonged.
- 4.4.2. The team which win two rounds, or the first team which receive two points within a specified period of time, wins the match. A team scores a point when wins the round. If the time expires before one of the teams scores two points, and one of the teams already has one point, the team with one point wins.
- 4.4.3. When neither team can win a match in the specified time period, an additional match can be held where wins the team the first awarded the point. Otherwise, the winner/loser of the match can be determined through voting by the referees or through the results of the rematch.
- 4.4.4. One point is given to the winner, if the winner is determined by a referee or by a vote among the referees.

## 4.5. End of the match

- 4.5.1. Match ends when the referee announces it. Teams take robots out of the ring area.

## 5. Match time

### 5.1. Duration

- 5.1.1. Match consists of up to 3 rounds with the duration of each up to 90 seconds, the start and the end with the referees command.

### 5.2. Extra time

- 5.2.1. If the referee announce an additional round, that round lasts 90 seconds maximum

### 5.3. Breaks during the match

- 5.3.1. The following time types are not included in the total match time:

- 5.3.1.1. From the moment the referee announces the awarding of points until the match is resumed. The standard pause before the resumption of the match is 30 seconds.
- 5.3.1.2. From the moment the referee announces the stop of the match until the match is resumed.

## 6. Awarding of points

### 6.1. Awarding of points for non-humanoid robots

- 6.1.1. Point is awarded to the robot in the following cases.
  - 6.1.1.1. Robot in accordance with rules forces the opponent robot to touch the space outside the ring inner area, including a side part of the ring.
  - 6.1.1.2. Opposing robot touches the space out of the ring inner area by itself.
  - 6.1.1.3. Any of this happens at the moment, when the end of the match is announced.
- 6.1.2. When a wheeled robot turn over on the ring and in similar cases, the point is not counted, and the match continues.
- 6.1.3. When the referee determines the winner, the following factors are taken into consideration:
  - 6.1.3.1. Robot motion and functioning technical peculiarities
  - 6.1.3.2. Penalty points scored during the match.
  - 6.1.3.3. Players behavior during the match.
- 6.1.4. The round should be stopped and assigned to a replay in the following cases:
  - 6.1.4.1. Robots come into mesh or circle around each other without any noticeable results within 5 seconds. If it is unclear whether there is a result, the referee may extend the observation time up to 30 seconds.
  - 6.1.4.2. Both robots move without any result or stop (simultaneously) for 5 seconds, without touching each other. However, if one robot first stop to move, after 5 seconds it is declared as the unwilling to fight. In this case, the opponent gets a point, even if the opposing robot stops too. If both robots move and it is unclear whether there is a result, the referee may extend the observation time up to 30 seconds.
  - 6.1.4.3. If both robots touch the space outside the ring at the same time, and it is impossible to determine who touched it first, a rematch is assigned.
- 6.1.5. Round may not be replayed more than three times. If it is still impossible to determine the result of the round the draw is scored as result of the round, i.e. none of the robots is awarded by the point.
- 6.1.6. Robot with maximal score winning the match. If two robots have the same scores after three rounds robot with the lower mass is winning the match.

### 6.2. Awarding of points for humanoid robots

- 6.2.1. One point is awarded to the robot taking a part in a “humanoid” class in the following cases:



## 6.2.1.1. Knockdown.

1. Knockdown occurs when the robot falls on the opponents ground.
2. 2 points are added to the score of the opponent.

## 6.2.1.2. Fall.

1. Fall happens when robot falls by itself.
2. One point is added to the score of the opponent.

## 6.2.1.3. Leaving the ring borders.

1. Leaving the ring borders occurs when any part of the robot touches the surface around the ring.
2. Three points are added to the score of the opponent.
3. Referee should allow the team which owns the robot to place it face down on the ring. If the robot manage to stand up in 10 seconds penalty is not assigned.

## 6.2.1.4. Knockout.

1. Knockout occurs when a robot doesn't manage to stand up within 10 seconds.
2. Knockout occurs when a robot cannot move or go within 10 seconds.
3. When the knockout is declared match is immediately ended and the victory at the match is awarded to the opponent.

## 6.2.2. All points for each round are summed up.

## 6.2.3. Round stops when robots don't touch each other for more than 15 seconds. This time can be increased to 45 seconds if the desire to fight is clearly visible.

## 6.2.4. Determination of the winner

### 6.2.4.1. The robot, which has more points wins the match.

### 6.2.4.2. If a tie on points, the referees vote for the winner, based on the tactics, aggression and activity.

### 6.2.4.3. If robots do not gain any points, the referees may decide that there is no winner of the match.

## 7. Violations

### 7.1. Violations

#### 7.1.1. Players who committed any kind of actions described in a section 7.2 or whose robots violating the rules of the section 2 shall be considered as violators of these rules.

### 7.2. Insults

#### 7.2.1. Player who tells the offensive words to the opponent, referee or embeds the playback devices in the robot, delivering insults, or writes insults at the body of the robot, or does any insulting actions that violate these rules.

## 7.3. Minor violation

Minor violation is declared if a player:

- 7.3.1. Enters the ring during the match, except for the cases when a player does so to take the robot away from the ring, when a referee awards the player a point or stops the match. Enter the ring means:
  - 7.3.1.1. Part of the player's body is in the ring.
  - 7.3.1.2. Player put any mechanical device in the ring, for example, in order to repair the robot.
- 7.3.2. Commits the following:
  - 7.3.2.1. Demands to stop the match without any valid reasons.
  - 7.3.2.2. Spends more than 30 seconds to prepare before resuming the match unless the referee extends the time.
  - 7.3.2.3. Robot starts to act before the end of the five seconds after the main referee announced the start of the match.
  - 7.3.2.4. Does or says something that concerns the honesty of the match.

## 8. Fines

- 8.1.1. Players who violate these rules, making the steps described in section 7.1, loses the match. Referee gives two points to the opponent and orders the violator to clear the ring. Violator doesn't have any rights.
- 8.1.2. Each case of violation described in section 7.3 is accumulated. Two such violations bring one point the opponent.
- 8.1.3. Violations described in section 7.3 are accumulated during one match.

## 9. Injuries or damages during the match

### 9.1. Request for stopping the match

- 9.1.1. Player may request to stop the match if he/she is injured, or robot got damage and the game cannot continue.

### 9.2. Impossibility to continue the match

- 9.2.1. When the game cannot continue due to injury or damage to the player's robot, the player who caused the injury or damage, loses the match. When it is unclear which team is the reason of the injury or damage the player, who cannot continue playing, or requests to stop the game, loses the match.

### 9.3. Time required to cope with damage or injury

- 9.3.1. If the game will continue in case of injury or accident shall be decided by the referees and the members of the Committee. Decision should be taken in no more than 5 (five) minutes.

## 9.4. Points for the player who cannot continue the game

- 9.4.1. The winner who is determined on the base of the provisions of section 9.2, receives two game points. The loser, who had already received one point, is still considered a loser. When the situation described in section 9.2 occurs in the extended match, the winner receives one game point.

## 10. Statement of disagreement

- 10.1.1. There may not be any objections to decisions of referees.
- 10.1.2. Captain of the team may appeal to the Committee, as long as the match is not finished in case there are doubts in compliance with these rules. If there is no Committee representatives at the game, the appeal may be lodged to the referee, as long as the match is not finished.

## 11. Miscellaneous

### 11.1. Flexibility of the rules

- 11.1.1. While the concept and basics of the rules are met, these rules should be flexible enough to respond to changes in the number of participants and the matches content. Change or cancellation of rules may be made by the organizers of the local competitions if they are published in advance and systematically supported during the competition.

## 12. Responsibility

- 12.1.1. Commands-participants are always responsible for the safety of their robots and are down to the law for any accidents caused by the participants or their robots.
- 12.1.2. The organizers do not take responsibilities and are not down to the law for any accidents caused by teams or their equipment.

## 13. History of regulations modifications

### 13.1. Version 3.5

- 13.1.1. Section enumerating has been changed. Section 1 "Introduction" has been deprived of the number, numbers of the following sections have been moved.
- 13.1.2. Changes were introduced into paragraphs 2.1.2, 2.5.1, 4.2.2, 6.1.1.1, 6.1.1.2, 7.1.1, 8.1.1, 8.1.2 (new enumeration).
- 13.1.3. Paragraphs 6.1.5, 6.1.6 have been added.

### 13.2. Version 3.4

- 13.2.1. Changes into tables 1 and 2 have been introduced.
- 13.2.2. Small corrections have been introduced.

## 13.3. Version 3.3

- 13.3.1. Section 3.5 “Additional restrictions” has been added into version 3.5 of these rules.
- 13.3.2. Paragraph 3.5.1 with additional restrictions for class “mini-sumo 15x15” has been added.

## 13.4. Version 3.2

- 13.4.1. “Micro sumo” class is introduced in the rules in accordance with the RobotChallenge rules.

## 13.5. Version 3.1

- 13.5.1. Paragraph 5.1.3 is updated (in accordance with the change in RobotChallenge regulations dated March 9, 2015).

## 13.6. Version 3.0

- 13.6.1. Main differences from “Mini sumo v2.02” rules:
  - 13.6.1.1. There are no restrictions on the dimensions after deploying robots.
  - 13.6.1.2. There are two new classes introduces - Sumo 15x15 cm and Humanoid Sumo.
  - 13.6.1.3. More simplified rules for the rematch.