

# DESIGN OF BRAKE PEDAL ASSEMBLY WELDING FIXTURE

Mr. Amol S. Sayambar<sup>1</sup>, Mr. Akshay S. Hapse<sup>1</sup>,  
Mr. Krushna S. Karad<sup>1</sup>, Mr. Somnath A. Berad<sup>1</sup>,  
Prof. Mr. Aniket V. Joshi<sup>2</sup>

<sup>1</sup>Students, B.E Mechanical Engineering, G.H. Raisoni College of Engineering And Management, Chas, Ahmednagar, Maharashtra.

<sup>2</sup>Prof. Mr. Aniket V. Joshi, Assistant professor, Department of Mechanical Engineering, G.H. Raisoni College of Engineering And Management, Chas, Ahmednagar, Maharashtra.

## Abstract

This paper bargains with the plan of welding installation for the brake pedal gathering of Auto rickshaw. The brake pedal welding installation comprise of five parts to be specific brake pedal, Bush, brake pedal plug, bracket, washer, that have to be welded each other with the desired resistance and welding quality with least time prerequisite and with least powers act. The fabric utilized within the make of distinctive parts of brake pedal welding installation get together is gentle steel. We have altered brake pedal welding installation since to reduce the work dealing with time and great quality of welding. All the parts of brake pedal welding fixtures carried out or modeling with the assistance of CATIA V5 and ANSYS Computer program. There are numerous sorts of manual welding installation utilizing completely different of Companies.

**Keyword-** Fixture, Welding Fixture, CATIA V5, FEA, Analysis, Design, Auto Rickshaw.

**1. INTRODUCTION** - Installations are devices that are utilized to hold a work piece in put whereas it experiences a machining or gathering prepare. They are utilized to guarantee tall quality and moo inconstancy in parts. Installations can be utilized in moo or tall volume manufacture operations. Initially the tremendous lion's share of installations was devoted installations since they were as it were made for one work piece. These installations have more benefits due to the tall solidness and the tall resilience's that may well be realized but they are moreover exceptionally costly. With the coming of adaptable fabricating frameworks, setups that are able to alter depending on the sort of item required to be made, and installations that are able to adjust to the changes are the foremost alluring. The installation could be a uncommon apparatus for holding a work piece in legitimate position amid fabricating operation. the subsidiary and holding the work piece, device is given. Visit checking, finding, isolated design and non-uniform quality in industrialized handle is decreased by installation. This diminishes operation time and development productivity and. It is by and large utilized within the mechanical generation since of increment efficiency. They are utilized to finding and blocking work pieces for machining, check, gathering and other operations. It comprises of a clamps and locators. Locators are utilized to decide the position of a work piece. Clamping has got to be suitably arranged at the arrange of machining installation plan.

### 1.1 Principle of Fixture

Fixtures are instruments that are utilized to hold a work piece in put whereas it experiences a machining or gathering process.

## 1.2 Requirement of Fixture

The installation may be a extraordinary apparatus for holding a work piece in appropriate position amid fabricating operation Installations are utilized to guarantee tall quality and moo changeability in parts.

## 1.3 Problem Statement

It is required whereas get together portion of brake pedal, bush, brake pedal bracket, plug bracket, bracket for brake pedal, washer. With least time necessity and with least powers. It too required legitimate arrangement, appropriate area, appropriate clamping whereas assembly.

## 1.4 Objectives

To plan and create the welding installation are brake pedal assembly.

To minimize time required for the collecting the brake pedal component.

To minimize endeavors required for the assembly.

To increment the precision and productivity.

To minimize item cycle time.

## 2. Methodology

The plan of the welding installation for brake pedal gathering is carried out as per the given in table plan the installation In this table, the beginning step begins with the fabric data and machine determinations geometric measurements and resistances required to be accomplished on the component , and distinctive parts of the brake pedal sub-assembly and their cad drawings which are modeled utilizing the program AUTO CAD and CATIA V5 Before the plan of the welding installation the installation conditions essential designate believed.

## 3. Scope

In the event that legitimate welding isn't done it'll specifically influence the quality of the component Fixture is the fabricating device that's utilized to diminish conversely and indistinguishable components. It diminishes or some of the time disposes of the endeavors of checking, measuring and setting of work piece on a machine and keeps up the exactness of performance. Increase in efficiency and keep up item quality consistently.

## 4. Fixture Design

Mass generation points at tall efficiency to diminish unit taken a toll and tradable to encourage simple gathering. This necessitates generation gadgets to extend the rate of fabricating and review gadgets to speedup assessment procedure. Generally, all the dances and installations comprise of following.

a) Locating Elements- These position the work-piece precisely with to the device put on the right track as well as setting modules in the fixture.

b) Clamping Elements- These grip the work-piece securely within the initiate position in the middle of operation.

c) Tool Guiding Elements- These help directing or setting of the apparatuses in adjust position with regard to the work-piece. Bore bushes direct the drills precisely to the work-piece. Handling installations make use of setting parts for precise positioning of processing cutters with concern to the work piece. Every portion has 6 degrees of Opportunity (3 Direct + 3 Rotating) which ought to be captured to guarantee legitimate area of the part in space. Fig. 1 appears the finding standards. The Area Guideline utilized to attain this is often called the 3-2-1 Principle.

**4.1 3-2-1 Principle**

3 Stands for - Least 3 Rests with clamps to set up a portion plane in this way limiting 1 Up-Down movement + 2 Rotary motions.

2 Stands for – A Circular finding stick in a round hole that limits motion within the 2 bearings within the established plane.

1 Stands for - A Circular finding stick in a space that confines the revolving movement within the built up plane almost the Installations are made from a assortment of materials, a few of which can be solidified to stand up to wear.

**5. Design calculation**

## 1. Base plate area

$$\text{Formula: } A = L * B$$

Where, L = length of plate (mm)  
B = width of plate (mm)  
A = 300\*260  
= 78000 mm<sup>2</sup>.

Considering force 500 to 1000N.

## 2. Bush for brake pedal

## I) Surface area of bush (base)

$$\begin{aligned} \text{Base area} &= \pi(R^2 - r^2) * h \\ A &= \pi(10^2 - 7^2) * 60 \\ &= \underline{9608.4 \text{ mm}^2} \end{aligned}$$

## II) Total surface area of bush

$$\begin{aligned} &= 2\pi(R+r)*(Rr+h) \\ &= 2*3.14*(10+7)*(10*7+60) \\ &= \underline{6725.88 \text{ mm}^2} \end{aligned}$$

## III) Locating pin :-

Length of pin = 45mm  
Inner dia. = 10mm  
Outer dia. = 17.5mm

$$\begin{aligned} A &= 151.66 \text{ mm}^2 \\ B &= 314 \text{ mm} \\ d &= \underline{13.9 \text{ mm}} \end{aligned}$$

## IV) Width of clamp

$$\begin{aligned} W &= 2.3d + 1.5748 \\ &= 2.3*13.9 + 1.5748 \\ W &= 33.54 \text{ mm.} \end{aligned}$$

## V) Thickness of clamp

$$\begin{aligned} t &= (0.85da(1-(a/b)))^{0.5} \\ &= (0.85*13.9*151.66*(1-(151.66/314)))^{0.5} \end{aligned}$$

$t = 42.32\text{mm.}$

VI) Load on bolt

$$T = (df/5)$$

$$F = (5T/d)$$

$$F = (5*8110/13.9)$$

$$F = 2917.26 \text{ N.}$$

VII) Moment on the strap

$$M = (FA(B-A))/(B)$$

$$M = (2917.26*151.66*(314-151.66))/(314)$$

$$M = 228739.98\text{N-mm.}$$

3.Toggle resting block

$$A = 6a^2$$

I. Area of top plate =  $l*b$   
 $A_t = 65*65$   
 $A_t = 4225\text{mm}^2$

II. Area of side plate =  $l*b$   
 $= 60*65$   
 $= 3900\text{mm}^2.$

III. Surface of area toggle resting block =  $6a^2$   
 $= 4(\text{side plate}) + 2(\text{top plate})$   
 $= (4*3900) + (2*4225)$   
 $A = 24050\text{mm}^2.$

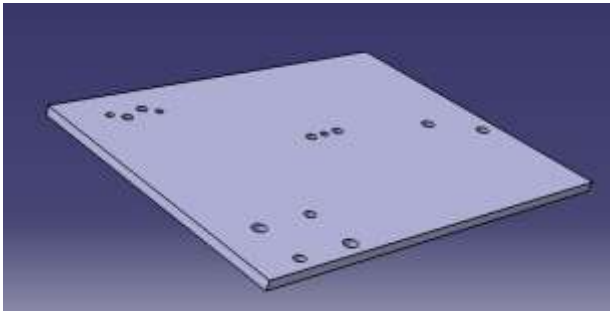
IV. Resting block for brake pedal

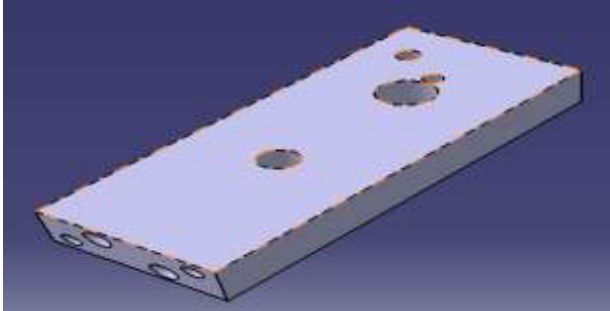
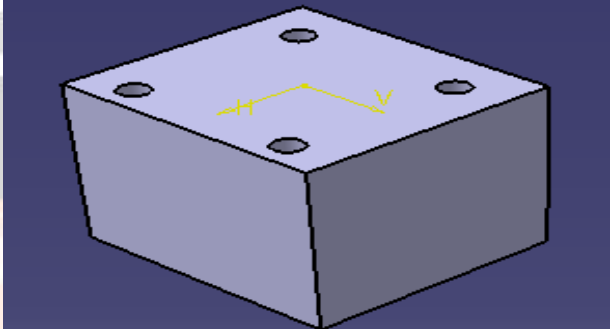
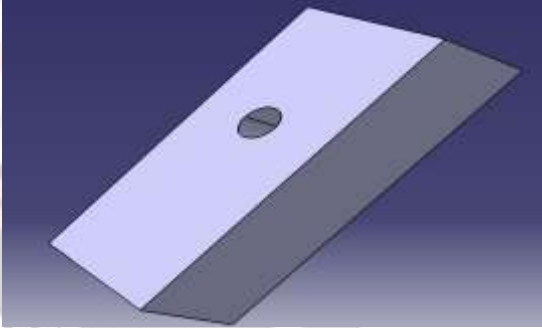
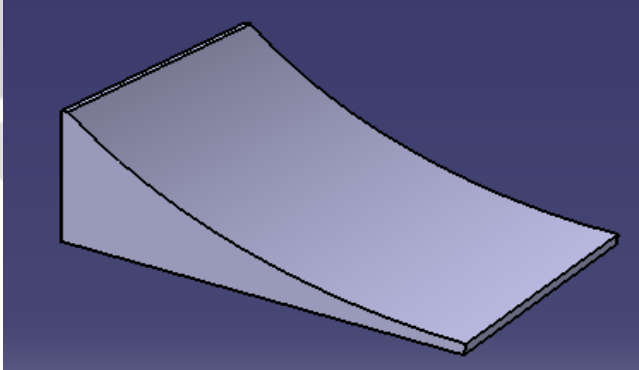
$$A = b*h*t$$

$$= 40*90*20$$

$$A = 72000\text{mm}^2.$$

**6. CAD MODEL OF FIXTURE COMPONENT**

Sr.No	Part Name	CAD MODEL
1.	Base plate Size :- 300*260 Material :- MS	

<p>2.</p>	<p>Pin Guide Block                  Size:- 50*128                  Material :- MS</p>	
<p>3.</p>	<p>Toggle Resting Block                  Size:- 65*65                  Material:- MS</p>	
<p>4</p>	<p>Resting Block                  Size:- 90*40                  Material :- MS</p>	
<p>5</p>	<p>Supporting Block                  Size:- 42*60, R8,H30                  Material:-MS</p>	

### 7. DESIGN AND ANALYSIS

The welding installation is to be outlined for welding a brake pedal gathering; consequently agreeing to the prerequisite of welding, components of installation are decided. Following parts are

#### 7.1.Base Plate

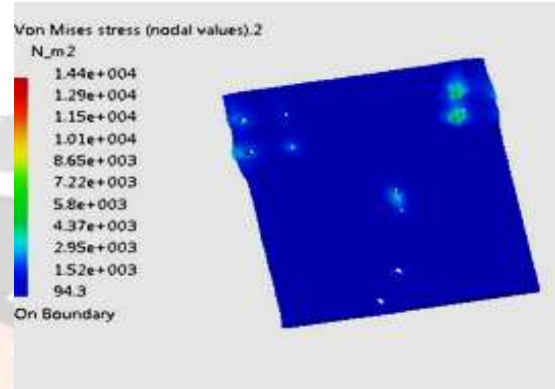


Fig.7.1.1.Base plate

Fig. 7.1. 2.Deformation on base plate

#### 7.2.Pin Guide Block

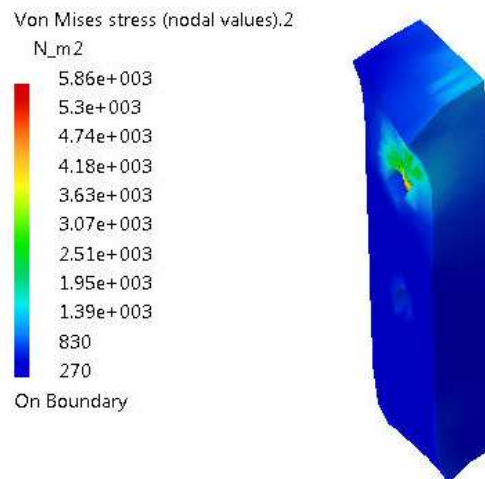


Fig.7.2.1.pin guide block

Fig.7.2.2.Deformation on pin guide block

### 7.3. Resting Block

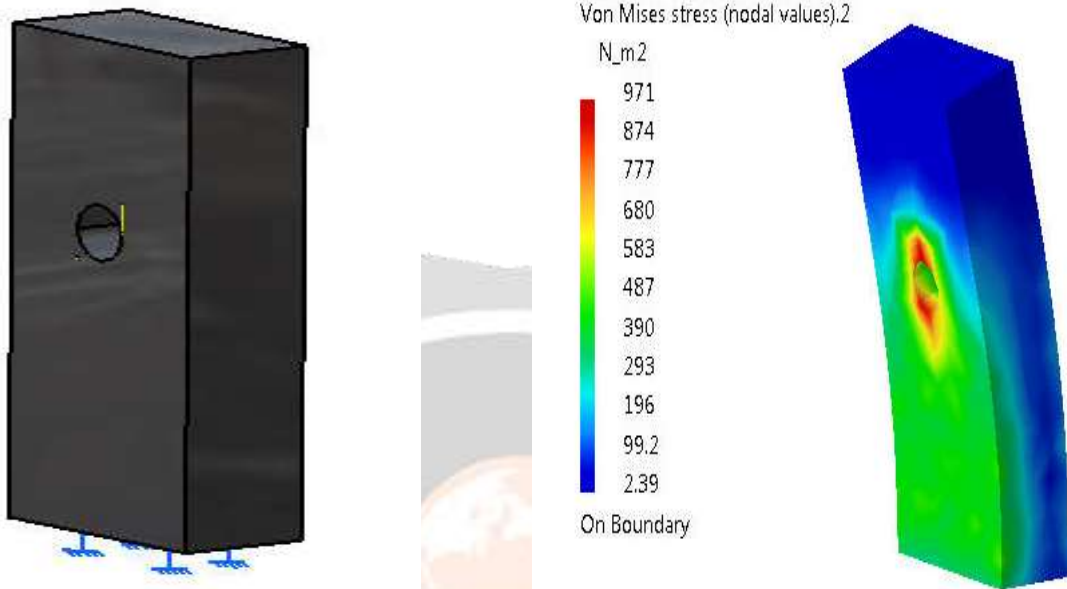


Fig.7.3.1. Resting Block

Fig.7.3.2. Deformation on Resting Block

### 7.4. Toggle Resting Block

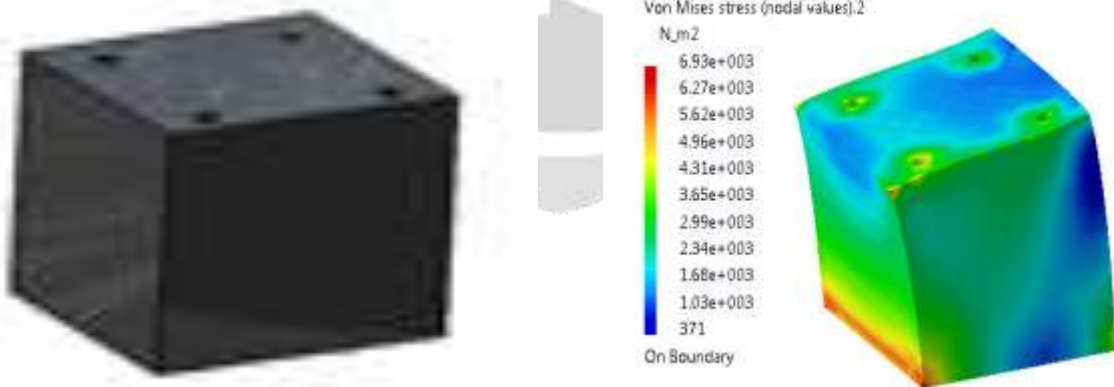
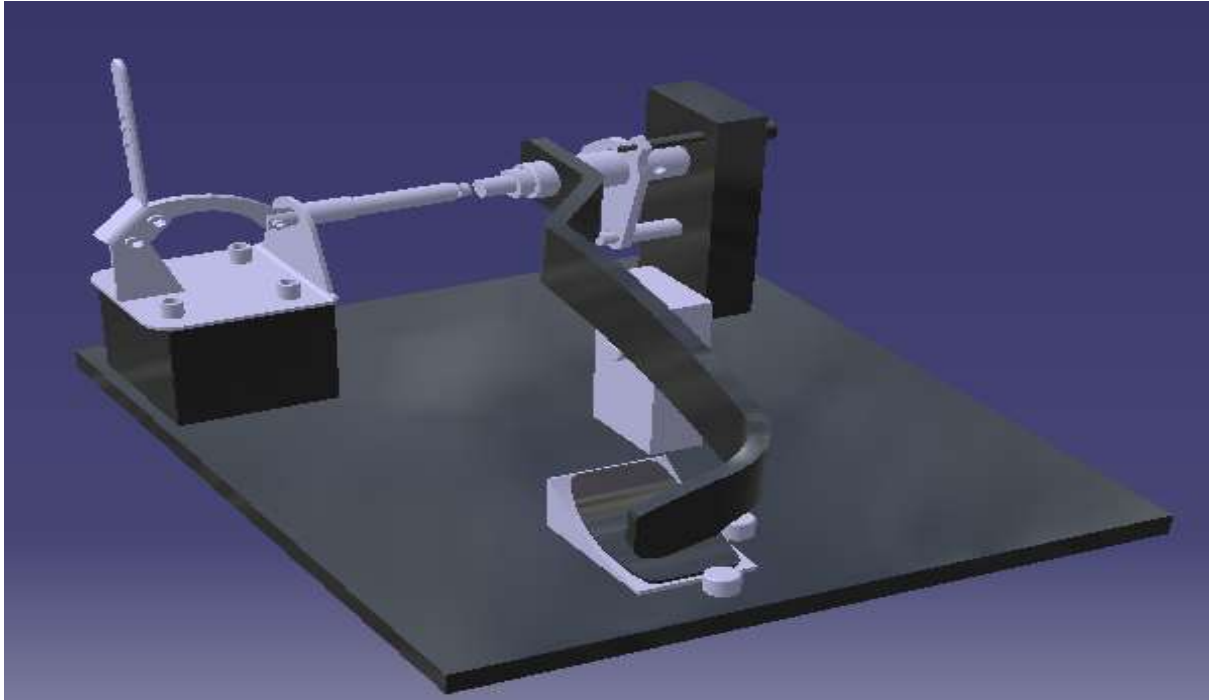


Fig.7.4.1. Toggle Resting Block

Fig.7.4.2. Deformation on Toggle Resting Block

### 7.5.Final assembly



**Fig.7.5.1** final assembly

### 8. SUMMARY

We have designed the brake pedal assembly welding fixture so the job loading and unloading of the parts will be easy for the labor or worker with minimized time requirement. It decreases or in some cases dispenses with the endeavors of checking, measuring and setting of work piece on a machine and keeps up the precision of execution. The work piece and instrument are generally found at their correct positions some time recently the operation consequently inside irrelevant time. So it decreases item cycle time. Capriciousness of estimation in mass era is uncommonly moo so manufacturing shapes supported by utilize of moves and establishments keep up a consistent quality. Due to moo changeability in estimation get together operation gets to be basic, moo expulsion due to less defective era is observed. It decreases the area cycle time so increases area capacity. At the same time working by more than one instrument on the same work-piece is conceivable. The slightest gap between the clamp and weld edge is found to be 12mm and this has been taken after inside the arrange sharpen of the welding establishment and at the foot of clamp plate the arsenic copper donate the bolster so that there's no impact of clamping constrain on the portion head conclusion sub-assembly.

### 9. ACKNOWLEDGEMENT

**Design and Development of Brake Pedal Welding Fixture** has been a wonderful subject to research upon, which leads one's mind to explore new heights in the field of Mechanical Engineering.

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Mr. Sayambar Amol S.

Mr. Hapse Akshay S.

Mr. Karad Krushna S.

Mr. Berad Somnath A.

## 10. REFERENCES

- [1] Jigar D Suthar, K.M .Patel, and Sanjay G Luhana fixture design accounting for the effect of work piece dynamics, International Journal of Advanced Manufacturing Technology, Vol. 18, pp. 701-707, 2001.
- [2] A. M. Mhaske, R. M. Metkar, S. D. Hiwase Automated setup and fixture planning system for box-shaped Parts International Journal of Advance Manufacturing Technology 45:540–552 DOI 10.1007/s00170-009-1983-1, 2008.
- [3] C. A. Kubade, Dr. S.V. Patil, Mr. V. P. Patil P.H Joshi A text book of “JIGS AND FIXTURES” 2nd edition Tata McGraw-Hill Publishing Company limited, New Delhi  
Nicholas Amaral · Joseph J. Rencis · Yiming (Kevin) Rong “Development of a finite element analysis tool for fixture design integrity verification and optimization” Int J Adv Manuf Technol 25: 409–419, 2005.
- [4] F. Sikstrom Et.Al M. C. Mittal, B. R. Ghose “ An Analysis of Fracture Toughness in the HAZ of GTA Welded Maraging Steel Welding Research Supplement , November 1989,pp432\_458.
- [5] Chen Luo, LiMinZhu Han Ding Chintan Prajapati, Rohit V. Bhaskar, “Design and Thermal Stress Analysis of Welding Fixture of a Brake Pedal” International Journal on Recent Technologies in Mechanical and Electrical Engineering (IJRMEE) ISSN: 2349 -7947 Volume: 2 Issue: 5
- [6] S. S. Khodwe, S. S. Prabhune, “Design and Analysis of Gearbox Test Bench to Test Shift Performance and Leakage” International Journal of Advance Research and Innovative Ideas in Education Volume 1 – issue2. (2015) Page 270-280.
- [7] Kalpesh Khetani, Jafar Shah, Vishal Patel, Chintan Prajapati, Rohit V. Bhaskar, “Design and Thermal Stress Analysis of Welding Fixture of a Brake Pedal” International Journal on Recent Technologies in Mechanical and Electrical Engineering (IJRMEE) ISSN: 2349 -7947 Volume: 2 Issue: 5
- [8] Y.J. Gene Liao, S. Jack Hu “Flexible multi body dynamics based fixture-work piece analysis model for fixturing stability” International Journal of Machine Tools Manufacture” 40, 2000.
- [9] Jigar D Suthar, K.M .Patel, and Sanjay G Luhana, “Design and analysis of fixture for welding an exhaust impeller”, Procedia Engineering 51 (2013) 514 – 519.
- [10] Luis E. Izquierdo1, S. Jack Hu1, Hao Du1, Ran Jin2, Haeseong Jee3 and Jianjun Shi2 “Robust Fixture Layout Design For A Product Family Assembled In Multistages Reconfigurable Line “Department of Mechanical Engineering. The University of Michigan 2350 Hayward Street, Ann Arbor, MI 48109
- [11] Yu Michael Wang and Diana Pelinescu “OPTIMAL FIXTURE LAYOUT DESIGN IN A DISCRETE DOMAIN FOR 3D WORK PIECES” 2001 IEEE International Conference on Robotics & Automation Seoul, Korea • May 21-26, 2001