

Industrial Robot Application in Automobile Industry in Countries of Asia

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Abstract- An assumption for satisfaction of needs and technological efficacy is related to: scientific knowledge, manufacturing operations, general technical organizational stage, engineering experience, equipment expediency and other vocational and human skills. Technological efficacies imply an improvement of technical solutions in automation domain of technological processes and application of intelligent systems in different industrial branches where automobile industry belongs to. There are a number of industrial robot applications in automobile industry today, in Asia and in other continents in the world. Their application is motivated by technical and economical reasons like: quality improvement of the completed products, fallout decrease (in montage processes), rate enlargement of the quality homogeneity-constancy (in all processes linked to robot application repeatability), security operation rate enlargement (in aggressive, burning, explosive and other areas, with the high rate of robot protection), decrease of the necessary work force in routine and repeatability processes, manufacture cost minimising and overall maintenance, fulfilment of demands required by a competition and more rigorous quality standards. This paper provides an analysis of industrial robot application in automobile industry in countries of Asia with an overview on application trend and future development of the same industry.

Keywords- *Industrial Robot; Automobile Industry; Robot Application; New Technologies; Automobile*

I. INTRODUCTION

In automobile industry the industrial robots are applied in processes from metal refinement till the final product obtaining, i.e. the control and montage of automobile. The industrial robots are an essential constituent element of the new manufacturing lines which are projected at the high automation rate, with the flexibility characteristics. The industrial robots highly increase the efficacy and higher rate of existing equipment efficiency, ensuring its economy. With constant modernization and automation of the manufacturing processes in automobile industry and in other industrial branches, with its flexibility and demands for the permanent change in manufacturing lines in automobile manufacture, the function of industrial robot becomes more demanding and complicated due to the increasing trend of the industrial robot application.

With the development of the new technologies and usage of the new materials in metal industry, the new manufacturing lines are demanded where the industrial robots are applied. The industrial robots are applied when it comes to the full system automation, fixed or flexible automation. The industrial robot application in automobile industry is used in: production of parts necessary for the automobile, engines, shells, painting, assembly, control etc. One of the characteristics of nowadays world economic course in automobile industry is market expansion, i.e. the necessity for constant modification of the existing products with the new technologies application, in order to provide the competition at the rough market conditions [1, 2, 3, 4, 5, 11, 17, 19].

A role of industrial robot is essential in such conditions of flexibility of manufacturing processes in automobile industry. Different structures of industrial robots in automobile industry are applied like: cylindrical, articulated-spherical, linear-rectangle and SCADA robot type. For some fields of application there are special robots, while for the other there are options of robots based on the process needs and robot's ability. Which of the aforementioned structures will be applied depends on the production process, production line and assignment that industrial robot has to carry out.

II. INDUSTRIAL ROBOT APPLICATION ANALYSIS IN AUTOMOBILE INDUSTRY IN COUNTRIES OF ASIA

A total industrial robot application has been shown in Asia/Australia in Fig. 1 and the statistical data have been taken from the International Federation of Robotics (IFR), United National Economic Commission for Europe (UNECE) and Organization for Economic Cooperation and Development (OECD) [1, 3, 6, 7].

When it comes to the industrial robot installation trend from 1998-2010, operational stock of industrial robots in Asia/Australia was an increase from 2002-2008, while in 2009 and 2010 (Fig.1 b) there is a slight fall.

The annual level of robot installation is different and the minimal installation has been recorded in 2001, 2002 and 2009. As it shows at Fig.1 annual supplies of industrial robots in Asia for 2010 were 69.833 units while operational stocks were 498.933 units. Reason for minimal annual supply of industrial robots 30.117 units in 2009 can be found in financial industrial crisis.

The analysis of industrial robot application in Asia through different industries has been shown in Table 1, Fig. 2 and Fig. 3.

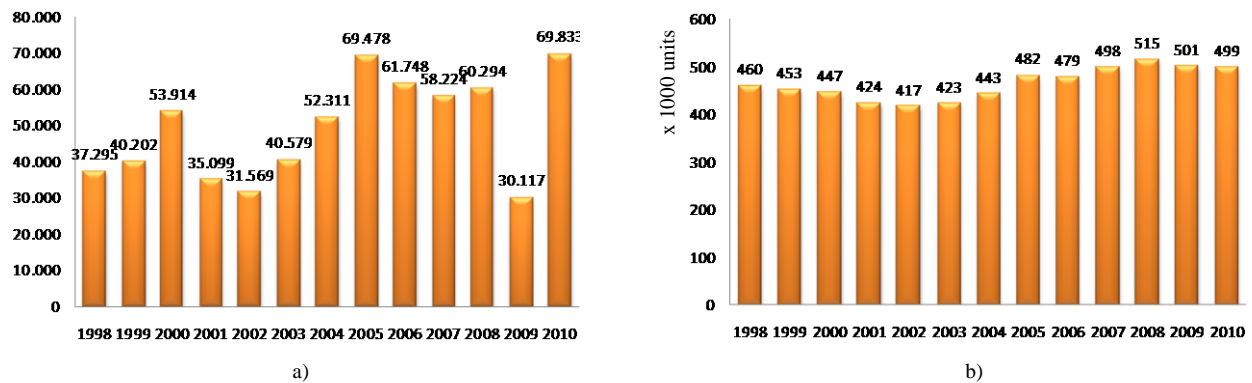


Fig. 1 Operational stock and annual supply of industrial robots in Asia/Australia

TABLE 1 ANNUAL INSTALLATION AND OPERATIONAL STOCK OF INDUSTRIAL ROBOTS IN ASIA/AUSTRALIA IN 2008-2010 [1, 6, 19]

Annual installation of industrial robots			
Industry/year	2008	2009	2010
Plastic and chemical	6.216	3.266	5.386
Metal product	4.971	1.362	2.378
Electrical/electronic	13.167	8.594	25.882
Automobile	20.728	8.342	14.644
Unspecified *	15.212	8.554	21.543
Total Σ	60.294	30.117	69.833
Operational stock of industrial robots			
Industry/year	2008	2009	2010
Plastic and chemical	56.849	55.028	50.387
Metal product	40.967	39.034	36.012
electrical/electronic	121.982	117.799	116.129
Automobile	159.838	158.826	158.089
Unspecified *	135.277	130.735	138.316
Total Σ	514.914	501.422	498.933

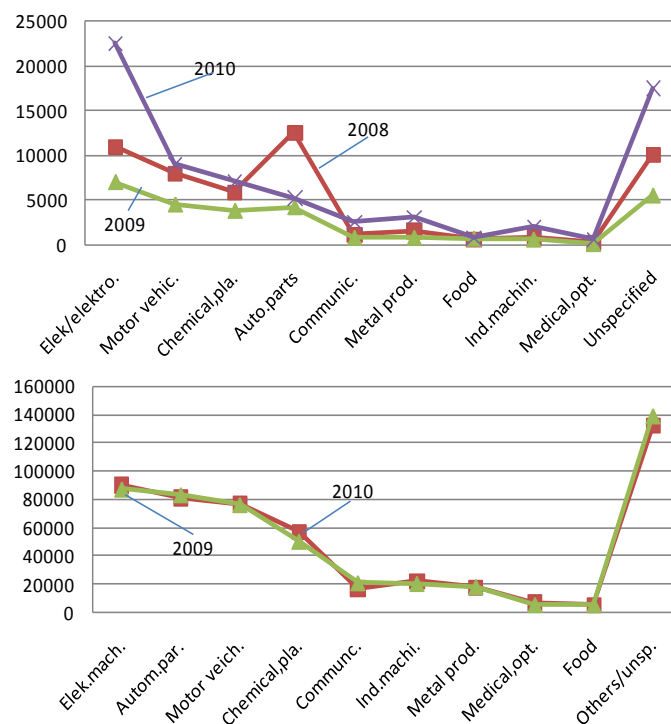


Fig. 2 Annual supply and operational stock of industrial robots by industrial branches in Asia/Australia in period 2008-2010 [1]

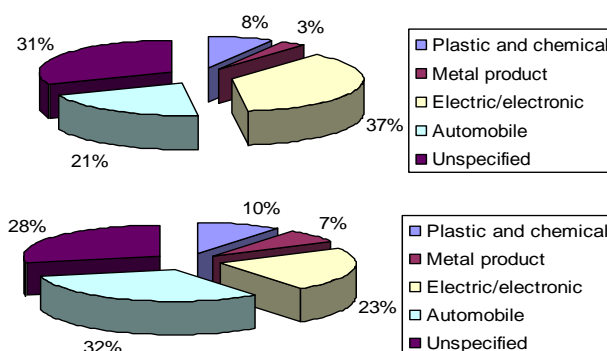


Fig. 3 Annual supply and operational stock of industrial robots by industrial branches in Asia/Australia in 2010



Fig.4 Industrial robots in welding process of automobile shell [20]

According to analysis of Table I, Fig. 1 and Fig. 3, it is obvious that in Asia/Australia in 2010 it has been applied for 130% more industrial robots than in 2009. In handling jobs 41%, welding 30%, automobile industry 21%, electro industry 37% and in chemical industry 8% of industrial robots have been applied in 2010 (Fig. 4).

If we look at total robot application in 2010, in relation to 2009, in Asia/Australia the difference is negligible. In handling operations 32%, welding 28%, but if we analyse the application through the industrial branches, the automobile industry (Fig. 5) amounts to 32%, electro/electronic with 23% and chemical industry with 10% of industrial robots.

There is a sudden fall of industrial robot application in 2009 due to financial industrial crisis. The Table 2 shows the annual and total industrial robot application in countries of Asia/Australia from 2008 to 2010. The countries are ordered according to the biggest total number of industrial robots in 2010, insomuch that Republic of Korea takes the first place, even though the biggest number of industrial robots has been applied in Japan.

TABLE 2 ANNUAL SUPPLY AND OPERATIONAL STOCK OF INDUSTRIAL ROBOTS BY ASIAN COUNTRIES IN PERIOD 2008-2010 [1, 6, 19]

Country/year	Annual supply of industrial robots		
	2008	2009	2010
Republic of Korea	11.572	7.839	23.508
JAPAN	33.138	12.767	21.903
KINA	7.879	5.525	14.978
TAIWAN	3.359	1.474	3.290
THAILAND	1.585	774	2.450
Country/year	Operational stock of industrial robots		
	2008	2009	2010
Republic of Korea	76.923	79.003	101.080
JAPAN	356.000	333.000	286.000
KINA	31.787	37.312	52.290
TAIWAN	23.640	24.365	26.896
THAILAND	6.340	7.832	9.746

In Table 2 are shown countries with annual supply of industrial robots above 2000 industrial robot units. The first place takes Republic of Korea with 23.508 units in 2010, the second place takes Japan with 21.903 units, the third place takes Republic of China with 14.978 of robot units.

Then the next countries like: Taiwan with 3.290 units, Thailand with 2.450 units. When it comes to operational stock of industrial robots in Asia, the first place takes Japan with 286.000 units, the second place takes Republic of Korea with 101.080 units, the third place takes China with 52.290 units and the fourth place takes Taiwan with 26.896 units, then the other countries follow.

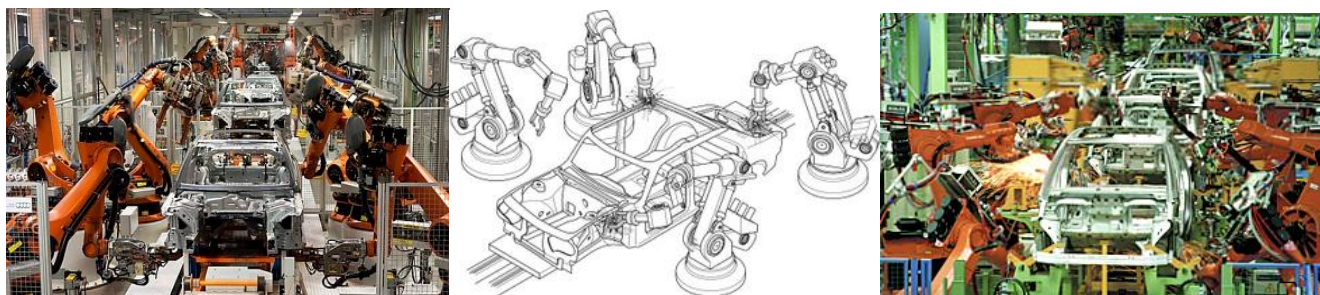


Fig. 5 Industrial robots in process of automobile manufacture [3]

It is obvious here that China is one of the countries in Asia who triplicated its application of industrial robots in 2010 in relation to 2009, and doubled in relation to 2008. It can be said that China is performing automation and modernization of its manufacturing processes, and as the highest process of application in automobile and electro/electronic industry is in Asia, China is already developing those industries in order to be competitive in a market.

The following figures show the industrial robot installation in countries: Republic of Korea, Japan, Republic of China, Taiwan, Thailand, and also the total industrial robot application and application in production processes in 2010.

A. Industrial Robot Installation in Republic of Korea

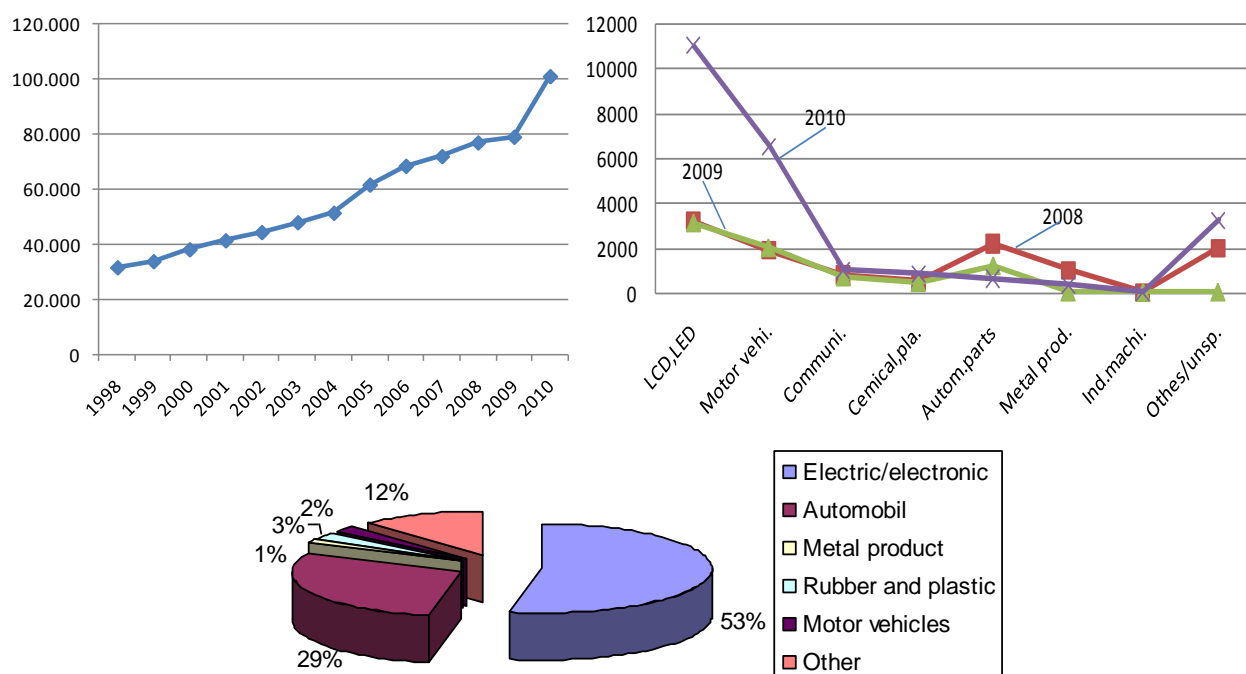
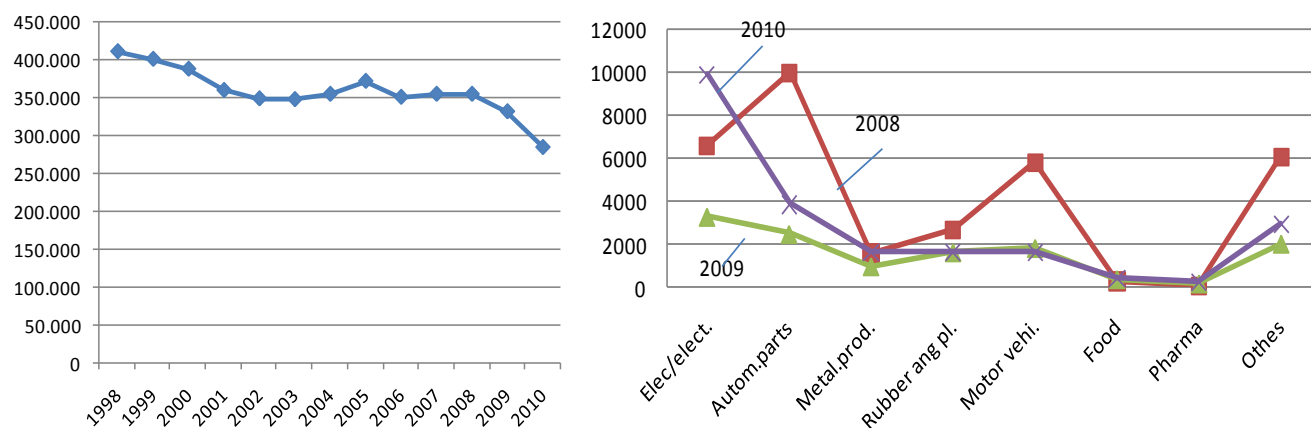


Fig. 6 Industrial robot installation by industrial branches in Republic of Korea in 2010 [1, 14]

B. Industrial Robot Installation in Japan



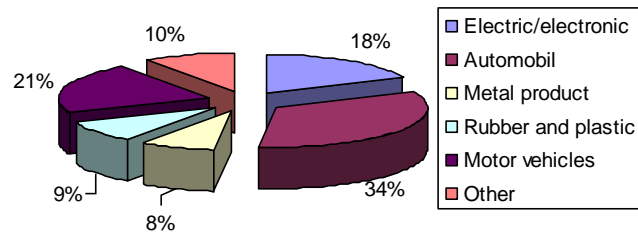


Fig. 7 Industrial robot installation by industrial branches in Japan in 2010 [1, 3]

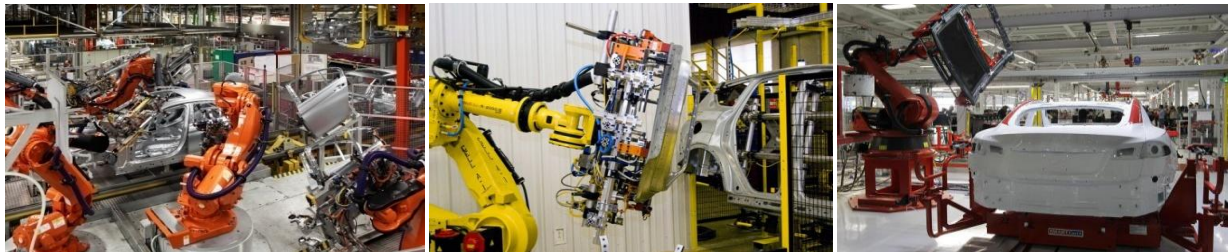


Fig. 8 Industrial robot application in automobile assembly [3]

C. Industrial robot installation in Republic of China

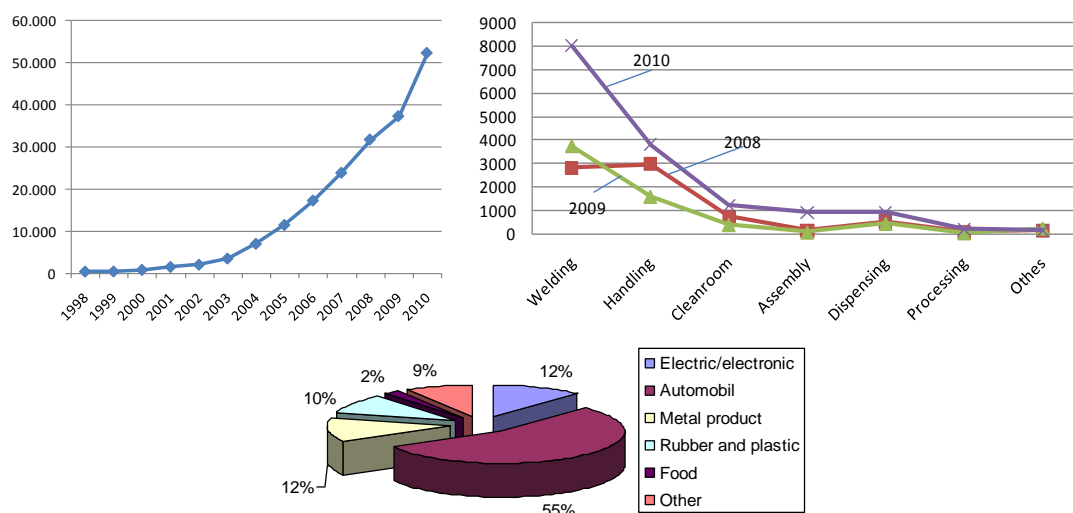


Fig. 9 Industrial robot installation by industrial branches and application areas in Republic of China in 2010 [1, 3]

D. Industrial Robot Installation in Taiwan

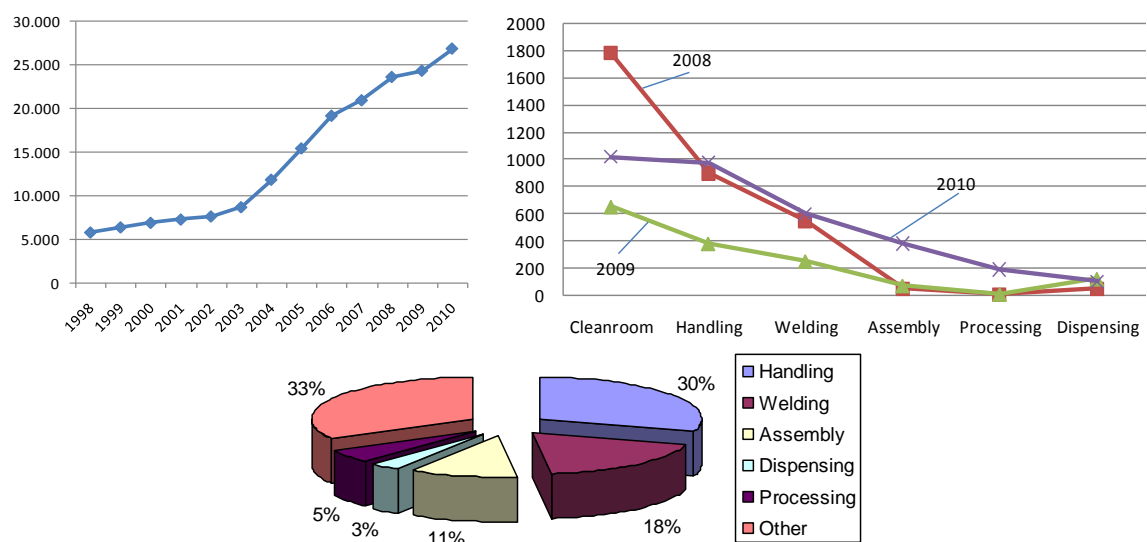


Fig. 10 Industrial robot installation by application areas in Taiwan in 2010 Taiwan [1, 3]

E. Industrial Robot Installation in Thailand

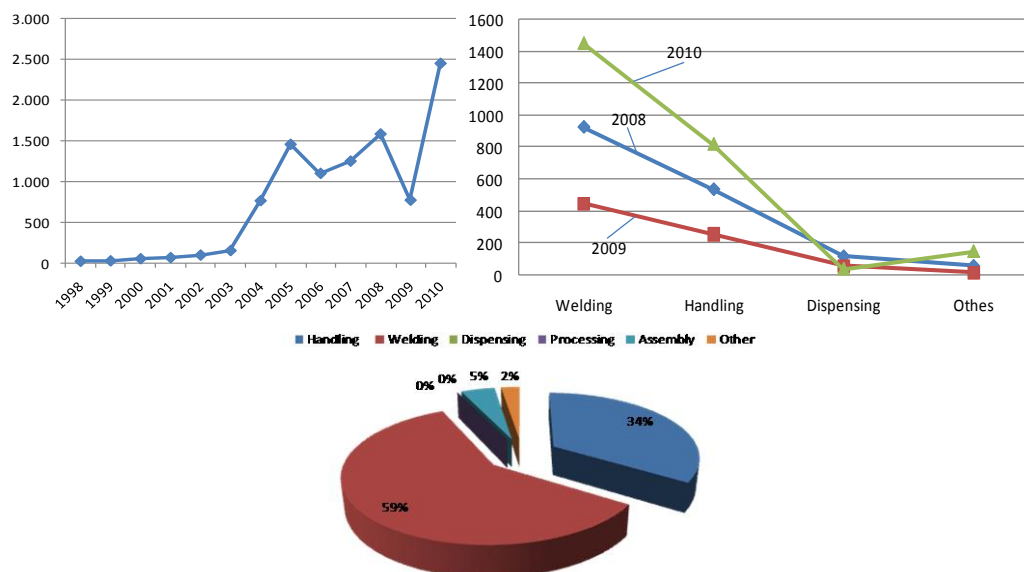


Fig. 11 Industrial robot installation by application areas in Thailand in 2010 [1, 3]



Fig. 12 Application of industrial robots in painting process and inspection of automobiles [3]

It is obvious that Republic of Korea in 2010 had operational stock about 101,080 of industrial robot units, with 29% installed in automobile industry, while Japan in 2010 had 286,000 of installed robot units, with 34% in productive drives of automobile industry. Republic of China in 2010 had 52,290 of industrial robot units, with 55% in automobile industry (Fig. 8); Taiwan in 2010 had 26,896 of installed industrial robot units with 18% in welding process, 11% in assembly process and 5% in processing. If all three processes are used in automobile industry, it can be anticipated that 27% of installed robots are used in automobile industry.

Thailand in 2010 had operational stocks about 2,450 of industrial robot units, with 59% installed in welding processes, and 34% in assembly processes. It can be anticipated that over 50% of installed robots in Thailand are used in automobile industry.

III. CONCLUSIONS

According to the analysis it is obvious that when it comes to the industrial robot application trend from 1998-2010, in Asia/Australia it is in constant increase at total level from 2002-2008, while in the last three years there is a slight fall at total level, and the annual application level in 2009 was minimal (due to financial industrial crisis) in the last twenty years.

In 2010 have been installed 69,833 of new industrial robot units, which is 39,716 units more than in 2009, in handling jobs 41%, welding 30% at annual level. Also in automobile industry 21%, electro industry 37% and chemical industry 8% of more applied industrial robots.

According to the number of applied robots in 2010 the first place takes Republic of Korea with 23,508 units, the second place takes Japan with 21,903 units, the third place takes Republic of China with 14,978 of robot units, then Taiwan with 3,290 units, Thailand with 2,450 units and then countries with lesser number of applied robots.

Republic of Korea in 2010 had totally installed about 101,080 of industrial robot units, with 29% installed in automobile industry, while Japan in 2010 had 286,000 of installed robot units, with 34% in productive drives of automobile industry. Republic of China in 2010 had 52,290 of industrial robot units, with 55% in automobile industry; Taiwan in 2010 had 26,896 of installed industrial robot units with 18% in welding process, 11% in montage process and 5% in processing process. If all three processes are used in automobile industry, it can be anticipated that 27% of installed robots are used in automobile industry.

Thailand in 2010 had operational stock about 2.450 of industrial robot units, with 59% in welding process and 34% in assembly process, and it can be anticipated that over 50% of robots work in automobile industry. China is one of the countries in Asia who triplicated its application of industrial robots in 2010 in relation to 2009. It can be said that China is performing automation and modernization of its manufacturing process in automobile industry and that is one of the reasons of such trend of industrial robot application. It is obvious that China is developing the automobile industry in order to be competitive on the market and find its place in the world in automobile industry.

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