Performance of FMS Simulation In A Virtual Environment

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Abstract- *Flexible manufacturing system is a system that is able to respond to changed conditions. In general, this flexibility is practiced in many industries. This present study explores the FMS in a virtual environment from the original real time data obtained from a selected industry. The discrete event simulation software arena is used to simulate the production data to obtain the practical approach of FMS in real time environment. The first category is the so called machine flexibility which enables to make various products by the given machinery. The second category is routing flexibility enabling to execute the same operation by various machines. Flexible manufacturing systems usually consist of three main parts: CNC machine tools, transport system and control system. The run results satisfy and match the real time results in a flexible manufacturing environment*

Keywords- Cell layout, FMS, CNC, and Arena.

I. INTRODUCTION

The matter of assembling and generation has developed to a framework subordinate movement from a "procedure just" action through history. This advancement has raised sensational upgrades in frameworks, for assembling to exceed expectations. In like manner, fabricating frameworks have created from work shop producing into stream shop producing, landing and no more propelled articulation; the Flexible Manufacturing System (FMS). The primary uses of adaptable assembling frameworks in mid 1960's have presented the rationality of adaptability in assembling; the key term to accomplish a practical generation, with accentuation on quality and client situated creation with shorter item conveyance times.

1.1 FLEXIBLE MANUFACTURING SYSTEM

Adaptable assembling framework is a framework that can react to changed conditions. Adaptability alludes to creating various unmistakable items in a clump shop Environment where open doors for generation flexibility exist. It is the capacity of an assembling framework to adapt to the evolving condition. Expanding the activity shop efficiency, keeping up the creation adaptability has been predictable wanted objective of the business. Rise of FMS is an improvement toward this path. Adaptable Manufacturing System (FMS) has developed as an answer for effective mid-volume creation of an assortment of part composes with low setup time, low work – in-process stock, short assembling lead time, high machine usage and high caliber. This innovation is particularly appealing for medium and low-volume enterprises, for example, Automobile, Aircraft, Steel and Electronics. FMS has risen as a very aggressive assembling methodology of the late twentieth century. The reasoning of FMS is in a perfect world suited for erratic market situations that request minimal effort answers for rapidly and adequately adjusting to changes in item blend, request and plan. "A Flexible Manufacturing System comprises of a gathering of preparing stations, bury associated by methods for a mechanized material taking care of and capacity framework, and controlled by an incorporated PC framework". In the course of recent years, the idea of adaptable assembling framework (FMS) has risen as a reasonable response to the issues of adaptability and productivity. Activities administration in a FMS is more unpredictable than that of the traditional assembling frameworks.

1.2 MOTIVATION AND SCOPE

Assembling administration should be furnished with new and compelling instruments due to the quickly changing and profoundly focused nature of the present worldwide markets. New age equipment and programming, customized into particular applications are being created every single day; however an achievement in decreasing costs, expanding effectiveness and enhancing quality isn't simple until the point when an application based joining of these segments is accomplished. An advanced Flexible Manufacturing System (FMS) with a solid framework demonstrate plan and the utilization of data advances answers these prerequisites

II. LITERATURE SURVEY

In this part the related writing and the authentic foundation for reproduction will be given an accentuation on the applications in logical and mechanical territories. The instrument utilized as a part of the investigation, in particular

ARENA® of Systems Modeling Corporation will be inspected, giving the highlights of the product quickly. The last piece of the writing study will be committed to the assembling frameworks, particularly to the adaptable assembling frameworks thinking about the uses of reproduction

Kelton et al (2004)**:-** the most reasonable sort of every, physical model incorporate the tabletop models that demonstration like the smaller than expected forms of the genuine office or framework, full scale adaptations of existing offices utilized as ridicule ups for experimentation, or flight or control room test systems utilized for preparing and crisis arranging. Then again, the nonexistent models include the scientific or potentially legitimate models that can likewise be moved into closely resembling PC programs. These subsequent projects coming about because of the models accompany an arrangement of approximations and suppositions to speak to the conduct of frameworks to be demonstrated.

J. Banks (2004). As a matter of first importance, it gives clients a chance to pick accurately among the conceivable options, gives time pressure and development as indicated by the sort of the recreated occasion, outfits the supervisors with the instruments to comprehend "why?" certain wonders happen in a genuine framework, enables the client to investigate potential outcomes of new strategies, working techniques or techniques

Altinkilic (2004) has introduced an utilization of recreation to enhance shop floor execution. The execution of the current framework is assessed by utilizing ARENA®. Because of the inspiration for overhauling the shop stream, producing cells are performed and the execution of the new framework is assessed and contrasted and that of the present framework. Subsequently, in light of a recreation examination, a few proposals are made to the administration of the said work shop generation framework.

J. Carson and D. Brunner (2000):- there will be an expansion in reproduction getting to be installed in other bigger programming applications and recreation will be all the more broadly utilized for continuous basic leadership as opposed to the conventional disconnected techniques.

III. MODEL DEVELOPMENT

This section incorporates the displaying endeavors performed for completing reproduction on Flexible Manufacturing Cell close by utilizing discrete occasion recreation programming ARENA. The principal areas depict the present framework as a Flexible Manufacturing System and the accompanying segments give the points of interest of the reenactment structure and the models created with an accentuation on Flexible Manufacturing System ideas.

3.1 PRESENT SYSTEM

Being a proving ground for some, past examinations, the adaptable assembling cell in Indian assembling fills in as the premise of the model in this investigation too. Contextual analysis is being embraced to catch the ongoing information for the recreation. Before stressing the displayed points of interest of the FMS, it is important to specify the current programming and equipment abilities of the framework.

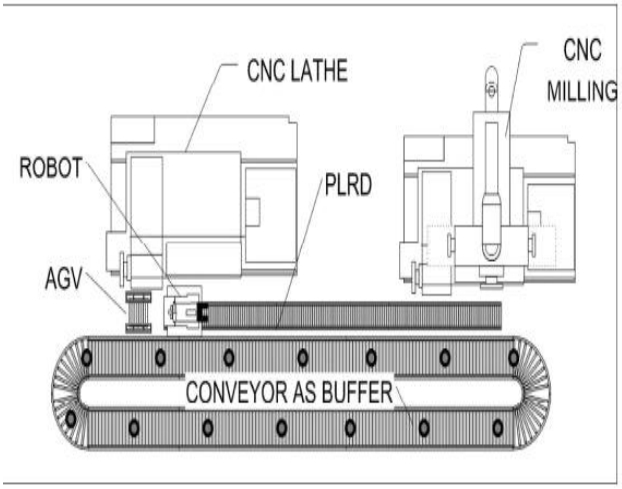

Figure 3.1: Layouts of FMS

3.2 SIMULATION STRUCTURE

Frameworks to be mimicked are very various as far as size and unpredictability. In any case, paying little heed to how complex a discrete-occasion framework might be, it is probably going to contain some fundamental parts that are additionally basic to adaptable assembling frameworks. The basic parts of a discrete-occasion reproduction incorporate elements, exercises and occasions, assets, worldwide factors, an arbitrary number generator, a timetable, insights gatherers and movement (Ingalls 2001). These basic components and their relations with adaptable assembling frameworks are depicted in the accompanying segments. The models created all through the examination are utilized as cases to show the strategies for application for demonstrating and reproduction.

IV. INTEGRATION OF SIMULATION MODELS

As depicted in past Chapter of writing survey, the fate of reenactment is accepted to involve arrangements about interoperability and interface of the recreation programming. Models that work incorporated with other programming are

favored to convey the utilization of reproduction to countless and straightforward and slick interfaces are proposed not to dishearten these clients and confound them.

4.1 OVERVIEW

The points of coordinating ARENA models with different applications and building redid ARENA interfaces are presented in this segment. The representation of these ideas is acknowledged with the models created for the FMS framework. Test code is created for this acknowledgment.

4.2 IMPORT DATA MODULE

This interface appeared in makes the fundamental worksheet to be utilized specifically by ARENA® as an information source. The client can without much of a stretch include new work orders utilizing this program or specifically control on the beforehand characterized work arranges by opening the work sheet that stores.

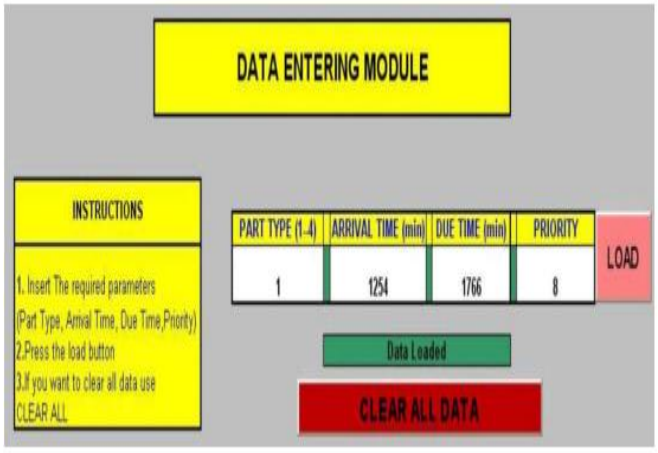

Figure 4.1 Developed interface for worksheet preparation

V. RESULTS AND DISCUSSION

With a specific end goal to check the validity of the created models a few runs are acknowledged under various situations. The outcomes acquired after these runs give a logical premise to assess the ideal sequencing calculation for parts to enter the framework. The situations of the runs, run parameters utilized as a part of the trials, and the aftereffects of these runs are portrayed in the accompanying sections.

5.1 RUN RESULTS FOR LPT SCENARIO

With a specific end goal to check the validity of the created models a few runs are acknowledged under various situations. The outcomes acquired after these runs give a logical premise to assess the ideal sequencing calculation for parts to enter the framework. The situations of the runs, run parameters utilized as a part of the trials, and the aftereffects of these runs are portrayed in the accompanying sections.

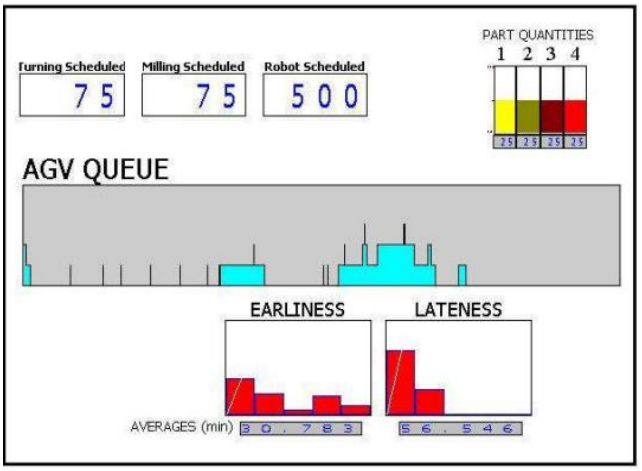

Figure 5.1 Graphical results for LPT scenario

5.2 MACHINING TIMES OF PARTS UNDER THE LPT SCENARIO

The information send out modules supply a similar data in a more formal and organized path, as far as sheets and outlines. Figures A.3 and A.4 are the outlines that are arranged consequently in Excel® to demonstrate the individual circumstances for times part spend in framework and the machining times. The machining times are assembled under 4 primary esteems, each relating to a particular part write. The time in framework esteems achieve a pinnacle estimation of around 300 minutes. It isn't a shocking truth that the comparing machining time for that part is just around 3 minutes which is one of the briefest esteems. The LPT decide powers that part to sit tight in the line for quite a while.

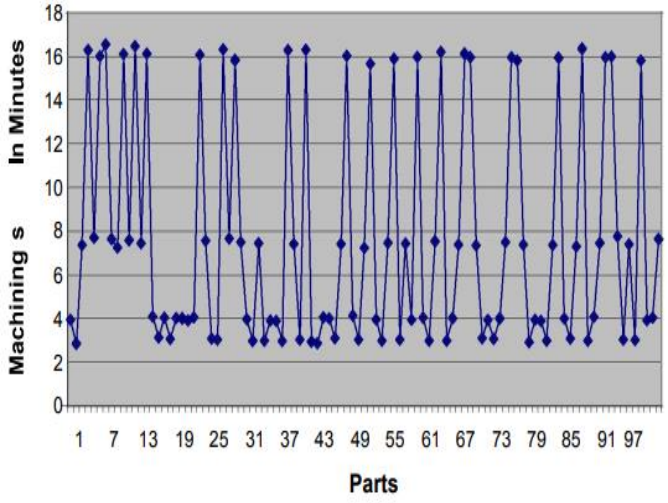

Figure 5.2 Machining times of parts under the LPT scenario

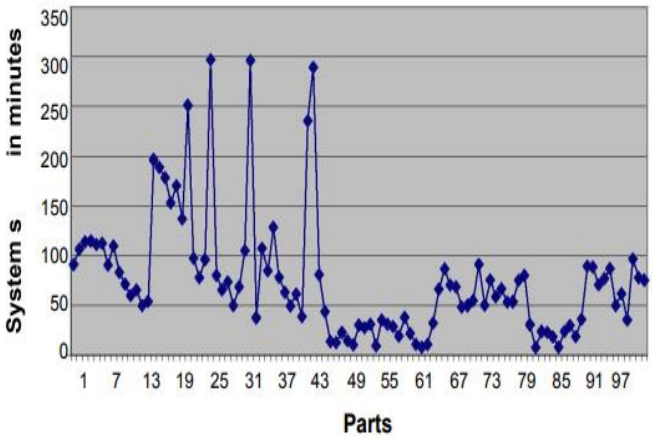

Figure 5.3Time in system for parts under the LPT scenario

The example of the outcomes demonstrates that parts of a similar sort are inclined to be taken into the framework therefore as their creation times are nearly the same. After the initial couple of parts that enter the framework in view of the non-presence of different kinds of parts, parts with longer preparing circumstances are acknowledged to the framework

Table 5.1 Part dependent simulation results

No	Type	Start	End	Duration	Earliness	Lateness	Turning	Milling	Machining
1	1	7,83	98,92	91,08		43,74	2,48	1,48	3,96
2	2	13,02	119,74	106,72		28,76		2,87	2,87
3	3	17,52	131,45	113,93		67,70	7,35		7,35
4	4	23,57	138,58	115,01		56,56	10,26	6,02	16,28
5	3	27,66	139,18	111,51		53,92	7,71		7,71
6	4	29,01	141,60	112,60		62,12	9,99	6,01	16,00
7	4	65,68	155,94	90,26		33,07	10,37	6,17	16,55
8	3	46,59	156,53	109,94		100,27	7,65		7,65
9	3	73,92	157,13	83,20	6,87		7,26		7,26
10	4	98,04	169,35	71,31	26,12		10,13	5,96	16,09
11	3	109,87	169,94	60,08	23,86		7,59		7,59
12	4	130,79	196,34	65,54		65,44	10,31	6,14	16,45
13	3	158,02	207,63	49,61		26,92	7,44		7,44
14	4	165,38	219,49	54,11	4,77		10,20	5,91	16,11
15	1	25,25	221,91	196,67		145,43	2,55	1,54	4,09
16	2	41,84	230,60	188,76		112,31		3,15	3,15
17	1	71,04	249,50	178,46		94,17	2,53	1,53	4,06
18	2	108,38	261,19	152,81		96,35		3,09	3,09
19	1	100,76	271,40	170,64		112,39	2,53	1,52	4,04
20	1	139,34	276,15	136,80		91,29	2,52	1,49	4,01
21	1	39,89	291,20	251,31		170,48	2,48	1,46	3,94
22	1	203,48	301,06	97,58		31,66	2,51	1,56	4,06
23	4	232,81	310,90	78,09		75,61	10,04	6,02	16,06
24	3	215,20	311,49	96,29		69,20	7,57		7,57
25	2	26,55	323,62	297,07		212,26		3,08	3,08
26	2	252,48	332,52	80,04		73,76		3,03	3,03
27	4	274,14	339,73	65,60		32,29	10,05	6,25	16,30
28	3	269,43	342,95	73,52		1,29	7,67		7,67
29	4	296,23	346,47	50,24	49,46		9,94	5,88	15,82
30	3	278,49	347,07	68,58	3,97		7,51		7,51
31	1	251,28	356,81	105,53		40,16	2,50	1,48	3,98
32	2	73,81	370,31	296,49		236,08		2,99	2,99
33	3	345,75	383,51	37,76	25,72		7,46		7,46
34	2	277,03	384,10	107,07		50,94		2,99	2,99
35	1	317,78	402,82	85,04		33,98	2,48	1,45	3,93
36	1	275,06	403,41	128,35		30,96	2,42	1,48	3,89
37	2	338,18	416,70	78,52		70,27		2,98	2,98
38	4	365,19	428,61	63,42		30,42	10,25	6,03	16,28
39	3	390,96	440,52	49,57	0,48		7,40		7,40
40	2	379,50	441,12	61,62		29,50		3,04	3,04
41	4	403,00	441,90	38,90		29,05	10,34	5,95	16,30
42	2	207,15	442,68	235,53		231,27		2,95	2,95
43	2	157,60	446,84	289,24		285,37		2,88	2,88
44	1	366,76	447,62	80,86		16,88	2,51	1,57	4,08
45	1	405,00	448,97	43,97		28,49	2,56	1,47	4,03
46	2	449,82	463,66	13,84	1,69			3,11	3,11
47	3	451,68	464,44	12,77		12,53	7,42		7,42
48	4	470,10	492,96	22,85		10,30	10,10	5,90	16,00
49	1	488,01	502,99	14,97	21,69		2,59	1,54	4,13
50	2	496,69	507,28	10,59	40,12			3,04	3,04
51	3	512,84	542,90	30,07	14,50		7,24		7,24
52	4	517,80	545,24	27,44	5,12		9,77	5,90	15,67
53	1	522,02	553,29	31,27	48,29		2,46	1,51	3,97
54	2	548,22	557,55	9,32	66,21			2,99	2,99
55	3	562,22	598,04	35,83		10,06	7,46		7,46
56	4	567,52	598,64	31,12		10,45	10,26	5,63	15,89
57	2	578,00	606,51	28,52	54,14			3,04	3,04
58	3	588,16	607,30	19,13	2,16		7,44		7,44
59	1	569,97	607,89	37,92		3,16	2,48	1,49	3,96
60	4	625,52	647,14	21,61	59,94		9,99	5,97	15,96
61	1	689,15	700,16	11,01	64,68		2,45	1,59	4,04
62	2	700,90	708,55	7,65		6,51		2,99	2,99
63	3	716,17	727,03	10,87	20,69		7,55		7,55
64	4	716,63	749,39	32,76	50,28		10,23	5,97	16,20

65	2	751,10	817,24	66,14	22,82			2,99	2,99
66	1	737,07	824,05	86,98		44,26	2,49	1,54	4,03
67	3	754,30	824,65	70,35		16,27	7,39		7,39
68	4	756,92	825,24	68,32		58,67	9,86	6,26	16,12
69	4	783,70	832,15	48,45		10,15	10,26	5,70	15,96
70	3	782,80	832,75	49,94	37,74		7,36		7,36
71	2	780,26	835,27	55,01		13,73		3,12	3,12
72	1	758,23	849,21	90,98		80,36	2,53	1,42	3,95
73	2	820,50	870,76	50,25	17,09			3,07	3,07
74	1	817,42	893,11	75,69		18,48	2,53	1,49	4,02
75	3	834,71	893,70	59,00		11,71	7,49		7,49
76	4	836,57	903,16	66,60		8,45	10,17	5,79	15,96
77	4	860,47	913,60	53,13		29,34	9,85	5,94	15,79
78	3	860,44	914,20	53,76		7,93	7,38		7,38
79	2	843,02	918,73	75,71		3,97		2,93	2,93
80	1	839,19	919,52	80,33		75,23	2,45	1,51	3,96
81	1	890,06	920,87	30,81	31,93		2,47	1,45	3,91
82	2	923,23	930,87	7,64	77,35			2,98	2,98
83	3	939,91	963,67	23,76	73,71		7,38		7,38
84	4	948,57	971,64	23,07	55,81		9,73	6,20	15,93
85	1	963,52	982,09	18,57	21,37		2,52	1,50	4,02
86	2	978,31	986,70	8,40	16,84			3,08	3,08
87	3	991,78	1015,39	23,61		21,84	7,30		7,30
88	4	997,78	1027,69	29,91		6,50	10,16	6,18	16,34
89	2	1015,06	1033,75	18,69		15,26		3,00	3,00
90	1	998,26	1034,54	36,28	59,44		2,57	1,53	4,10
91	3	1050,41	1140,14	89,73		13,63	7,47		7,47
92	4	1052,17	1140,74	88,56	1,31		10,01	5,95	15,96
93	4	1070,62	1141,43	70,81		66,67	10,19	5,79	15,99
94	3	1069,97	1147,23	77,26		33,75	7,76		7,76
95	2	1060,89	1147,92	87,03		44,18		3,06	3,06
96	3	1102,26	1152,02	49,76	2,85		7,40		7,40
97	2	1090,55	1152,70	62,15		17,47		3,02	3,02
98	4	1117,94	1153,68	35,74	63,82		9,89	5,92	15,81
99	1	1057,40	1154,37	96,96		54,24	2,44	1,49	3,94
100	1	1077,00	1155,15	78,15	4,55		2,50	1,56	4,06
AVERAGES		**520,80**	**596,16**	**75,36**	**30,78**	**56,55**	**6,69**	**3,50**	**7,64**

5.3 SUMMARIES OF RESULTS

At the point when the lateness esteems are concerned it is watched that the EDD standard gives the base normal to delay esteems, which is a normal outcome. The long holding up times in SPT and LPT calculations increment the time in framework esteems for particular part composes, which thusly expands the delay esteems. The "just a single part in framework" standard of FCS brings about hoisted esteems forever subordinate insights aside from earliness esteems. The utilization of EDD does not ensure the base number of late occupations. This reality is seen on Table 5.2 as the base number of late occupations is achieved in the FCFS run the show. This isn't an astounding outcome as the due dates are subject to the framework entrance time.

Turning, processing and thus the machining times are relatively equivalent for all example keeps running as the part numbers and sorts utilized as a part of the considerable number of runs are the same. The significance of this measurements emerges when the aggregate assembling times are contrasted and make ranges of the parts. In the best design that limits the time in arrangement of the parts, FCFS run, the normal assembling time is around 14% of the normal make traverse of the parts. In the most sad case this esteem drops to around 7.5 %. The impact of this reality shows itself through low usages of machines.

The usage of turning and processing machines are around 45% and 25% separately and don't vary in critical sums starting with one situation then onto the next. This is additionally a normal outcome, as the situations specifically influence the framework entrance successions for parts and there is no machine subordinate sequencing. Another reality distinguished through these usage and machining times' esteems is that the framework is profoundly transportation and capacity implies needy as more often than not parts spend in the framework are because of looking out for the transport.

The number in AGV measurement is critical to recognize the AGV limit. Of course, The FCS situation brings about the most number of both normal and greatest parts on the AGV as just a single part is acknowledged into the framework. The LPT and need situations additionally cause lifted number of parts looking out for AGV as less earlier parts or, parts with short preparing circumstances are compelled to remain on the AGV for long circumstances. The greatest number of parts on AGV is likewise vital as the limit is specifically reliant on this esteem. The SPT situation brings about minimal number of both most extreme and normal substances on AGV.

VI. CONCLUSION AND FUTURE WORKS

6.1 CONCLUSION

- The actual aim to be expected from a simulation study is its supplying a scientific basis for making decisions about the modeled system.
- The preparation procedure of the runs and the interpretation of the results obtained through the developed software are important to provide an idea on the effective use of simulation in manufacturing system
- The developed software provides the infrastructure and it is the management's task to analyze the results and respond to the facts of the system. as the final component of study, sample simulation runs under different scenarios of production are presented.
- The preparation procedure of the runs and the interpretation of the results obtained through the developed software are important to provide an idea on the effective use of simulation in manufacturing system.

6.2 FUTURE WORKS

The results of the models cannot be directly verified with the existing agent based system as the system is limited considering the number of work orders that can be processed at the same time. The verification is done by comparing the responses of the system with the responses of the models.

The bidding times those contribute to the overall systems times in the actual FMS are neglected through the modeling approaches. Actually the response of the system under heavy workloads is unpredictable due to computer crash problems. So bidding times that contribute to less than %1 of task make spans is neglected during modeling.

REFERENCES

[1] Roy, D., &Anciaux, D. (2001). Shop-floor control: a multi-agent approach International Journal of Computer Integrated Manufacturing, 14(6), 535–544.
[2] Bruckner, S (2000). Return from the ant synthetic ecosystems for manufacturing control. Thesis Humboldt-University of Berlin, June.
[3] Buitenhek R, Baynat B, Dallery Y. Production capacity of flexible manufacturing systems with fixed production ratios. Int J Flexible Manuf System 2002;14(3):203–26.
[4] Kumar R, Tiwari MK, Shankar R. Scheduling of flexible manufacturing systems: an ant colony optimization approach. ProcInstMechEng 2003;217(10):1443–53.
[5] Koo PH, Jang J. Vehicle travel time models for AGV systems under various dispatching rules. Int J Flexible Manuf System 2002;14(3): 249–62.
[6] Phadke S. Quality engineering using robust design. Englewood Cliffs, NJ: Prentice-Hall International; 1989. Luggen, W. W., 1991, Flexible Manufacturing Cells and Systems, Prentice Hall, p. 19- 378
[7] Ostwald, P., F., Muñoz J., (1997), Manufacturing Processes and Systems, 9th ed., New York, John Wiley & Sons,
[8] Law, A.M., McComas M.G.,(1999) Simulation of manufacturing system
[9] Williams, C.R., Chompuming, P., (2002) "A simulation study of robotic welding system with parallel and serial processes in the metal fabrication industry
[10] Pujo, P., Kieffer, J.P (2002). Me´thodes Du Pilotage Des Syste`mes De Production (Traite´ IC2, Se´rie Productique), Hermes Lavoisier.
[11] Altinkilic, M.,2004 Simulation-based layout planning of a production plant", Proceedings of the 2004 Winter Simulation Conference, pp 1079-108.
[12] Van Looveren, A.J., Gelders, L.F. and Van Wassenhove, L.N., A review of FMS planning models in modeling and design of FMS, edited by A. Kusiak, pp3- 31, Elsevier, Amsterdam, 1986
[13] Kelton, W. D. , Sadowski R.P., and Sturnock, D. T., (2004), Simulation with Arena, 3 rdInternational Edition, McGraw - Hill, New York Corresponding Author – AnoopKushwaha, Mail-