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A Study and Application of Scatter Search Feed ACO Algorithm in Forecasting the Influence of Turning Parameters during AlMg1SiCu Machining

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ABSTRACT

AlMg1SiCu composites owing to their numerous advantages—they are used for parts exposed to high temperatures (pistons, engine blocks, combustion chamber inserts) in systems undergoing intensive friction. The material removal rates in the machining operations are one of the most important deciding factors addressing to the quantity in production. To ensure in meeting the demand maximizing the MRR is necessary. This investigation involves in optimising the MRR of turning operations on AlMg1SiCu composites with the hybridization application of two optimization algorithms Scatter Search Feed ACO Algorithm. The second best algorithm's (Scatter Search Algorithm) outcome is taken as the input to the first best algorithm (Ant Colony Optimisation Algorithm) based on the assessment of performance indicator Mean Squared Error (MSE). Machining speed, feed, depth of cut and material removal rate are chosen as the process parameters. Regression equation modeling, analysis and optimization algorithms are used to recognize the parametric influence and optimization.

***Key words**- AlMg1SiC composite, Turning, Regression, Scatter Search Algorithm, Ant Colony Optimisation Algorithm, hybridization, Optimisation, Minitab, MATLAB.*

I. INTRODUCTION

In the recent past industrializing through attaining the precise quality of manufactured goods with realistic cost and time is extremely required move toward by every manufacturer. Composite materials with an aluminium matrix reinforced with ceramic particles and /or fibres are finding increasingly extensive applications in the aviation, machine, automotive and electronic industry, and the most advanced ones are adapted to the needs of the arms and space sector and for professional sports equipment. Moreover owing to their numerous advantages they are used for parts like pistons, engine blocks, combustion chamber inserts which are exposed to high temperatures and in discs, clutch and brake drums systems undergoing intensive friction as well as in drive systems achieving a small friction coefficient and a high vibration absorption ability. The recognition of right line of attack of processing, with right selection of machining parameters combination for the selected material are highly important which calls for investigation of the process through every aspect. Turning operations are the common applied metal cutting process towards the bringing the product into close specification and widely employed also. Highly automated machining centres are also nowadays in existence to accommodate this objective. At the time of operation the selection of suitable parameter combination is highly essential. The production volume of any product is mainly associated with the materials properties and process parameters like machining speed; tool feed rate, depth of cut, tool material and properties etc. Alakesh Manna and Sandeep Salodkar [1] have conducted experiments on E0300 alloy material through turning operations and analysed the outcome of the observation with Dynamic programming and Anova technique. They have developed a mathematical model and proposed for proper selection of the turning parameters. Muthukrishnan et al. [2] have applied ANN as well as ANOVA analysis for optimization of machining parameters in turning AlSiC composites and established that both ANOVA and ANN modeling tender an ordered and competent way on optimization. Basavarajappa et al. [3] have recognized the degree of impact and influence of speed and feed on drilling of hybrid metal matrix composites through Taguchi techniques in their experimental investigation.

Raviraj Shetty et al [4] have experimented on the age hardened AlSiC - MMC in turning operations with CBN cutting tool and optimised the cutting parameters through Taguchi optimization methodology. With the aid of the deterministic approach in order to advocate the selection of cutting conditions economically in single pass turning operation towards optimising the machining variables was advocated by Wang et al.[5]. In the turning process of GFRP composites with cemented carbide tool, Isik and Kentli [7] have investigated the depth of cut, cutting speed and feed rate influence on the output variable to minimize the tangential and feed force. The technique adopted was the Weighting techniques with the idea of bringing all the objective functions jointly with applying different coefficients for each. Kumar et al. [8] have conducted experimental investigation on unidirectional glass fiber reinforced plastics composites with a polycrystalline diamond tool and optimized turning parameters based on the Taguchi’s method with regression analysis. They developed model for prediction of surface roughness and material removal rate in machining.

Mustafa and Tanju [9] anlysed the effect of feed rate, cutting speed and depth of cut on the respondent variables like surface roughness, cutting temperature and cutting force in turning operation experiment using diamond like carbon coated cutting tools on the aluminum 7075 alloy. Aruna and Dhanalaksmi [10] have proposed a distinct model for predicting the surface roughness refereeing to the cutting speed, feed and depth of cut using response surface methodology. Surface roughness contour for cutting speed-depth of cut is developed to describe the values resulting from the cutting parameters selected. Saha and Mandal [11] investigated multi response optimization of turning process for an optimal parametric combination to yield the minimum power consumption, surface roughness and frequency of tool vibration using a combination of a grey relational analysis.

In this present investigation the identification of the level of influence of the cutting variables on the MRR of the AlMg1SiC composite alloy material in turning operations is carried out. Scatter Search Algorithm, Ant Colony Optimisation Algorithm are programmed in the MATLAB for identifying such parameter combination and the suitability of the algorithm is assessed for further applications. Statistical regression relationship between the process parameters is chosen as an additional support to get the improved results. The optimised parameters combinations are identified with the tuned results through the simulation.

II. EXPERIMENT AND OBSERVED DATA

For the investigation of the material removal rate on the material AlMg1SiC composite alloy in turning operations on NC controlled machine tool of Hi-Cut 3503 make Carbide insert cutting tool (tool holder- SVJBL 2020K 11 and insert- DCMT 11T308- PM 4225) was used by [9] Rahul Dhabale., and Vijaykumar S. Jatti. The chemical composition of the specimen material is specified in Table 2.1 followed by the vital mechanical properties in Table 2.2. The specimen was prepared to the dimension 35 mm diameter x 300 mm long and was cleaned prior to the experiments by removing 0.3mm thickness of the top surface in order to eliminate any surface defects and wobbling.

Table 2.1 Chemical composition of AlMg1SiC composite alloy

Element	Weight %	Element	Weight %
Al	97.9	Cu	0.28
Si	0.60	Mg	1.0

Table 2.2 Properties of the AlMg1SiC composite alloy specimen

Property	Quantity (Units)
Density	2.7 g/cc
Ultimate tensile strength	310 MPa
Tensile yield strength	276 MPa
Modulus of Elasticity	68.9 GPa
Brinell Hardness (500 gm load & 10 mm ball)	95 BHN

As mentioned in the Table 2.3, the machining input cutting variables cutting speed, feed rate and depth of cut were chosen with three levels.

Table 2.3 Input machining parameters level selection

Machining parameters	Units	Level 1	Level 2	Level 3
Cutting Speed	(rpm)	280	710	1120
Feed	(mm / rev)	0.0508	0.1016	0.1524
Depth of cut	(mm)	0.4	0.8	1.2

Table 2.4 Experimental data

Exp. No.	Cutting Speed (rpm)	Feed Rate (mm/ rev)	Depth of Cut (mm)	Material removal rate (mm^3 / sec)
1	280	0.0508	0.4	306.67
2	280	0.0508	0.8	609.76
3	280	0.0508	1.2	909.28
4	280	0.1016	0.4	582.94
5	280	0.1016	0.8	1158.73
6	280	0.1016	1.2	1727.36

7	280	0.1524	0.4	943.34
8	280	0.1524	0.8	1875.96
9	280	0.1524	1.2	2797.84
10	710	0.0508	0.4	793.04
11	710	0.0508	0.8	1577.02
12	710	0.0508	1.2	2351.92
13	710	0.1016	0.4	1555.25
14	710	0.1016	0.8	3092.37
15	710	0.1016	1.2	4611.35
16	710	0.1524	0.4	2196.85
17	710	0.1524	0.8	4366.5
18	710	0.1524	1.2	6508.93
19	1120	0.0508	0.4	875.13
20	1120	0.0508	0.8	1735.95
21	1120	0.0508	1.2	2582.46
22	1120	0.1016	0.4	1745.24
23	1120	0.1016	0.8	3461.88
24	1120	0.1016	1.2	5149.9
25	1120	0.1524	0.4	2549.2
26	1120	0.1524	0.8	5055.49
27	1120	0.1524	1.2	7518.86

L_{27} array was taken for the experiment conducted and the Material removal rate was considered as outcome variables. Fourteen equal parts of 20mm length were marked on the work pieces and material removal rate was calculated using following formula; $MRR = ((\pi / 4) (D_1^2 – D_2^2) \times f \times N$. where the D_1 is Initial diameter, mm; D_2 is Final diameter, mm; f is feed rate, mm / rev; and N is spindle speed, rpm. The machining processes were carried out as dry machining process and subsequently the responses with reference to each observation were arranged in Table 2.4.

III. STATISTICAL ANALYSIS

The influences of the input machining parameters (speed, feed and depth of cut) on the output parameter (material removal rate) are analysed by statistical regression relationship in the Minitab17 software. Over than the linear regression of first order, the second order regression relationship between the variables shows higher level significance through the values of the R – sq. Both the first and second order statistical values of R-sq can be viewed from the Table 3.1.

Table 3.1 Regression model comparison for surface roughness

Parameter	Regression	S	R-sq	R-sq(adj)	R-sq(pred)	Durbin - Watson
MRR	First order	809.364	83.70%	81.58%	76.14%	1.32450
	Second order	273.44	98.63%	97.90%	95.58%	1.42117

The second order regression equations through the Minitab17 for the material removal rate in terms of input parameter combination are:

$$MRR = (141) + (2.90 \times Cs) - (13936 \times f) - (2070 \times Doc) - (0.003797 \times Cs^2) - (13258 \times f^2) - (56 \times Doc^2) + (24.06 \times Cs \times f) + (29804 \times f \times Doc) + (3.230 \times Cs \times Doc) \quad (3.1)$$

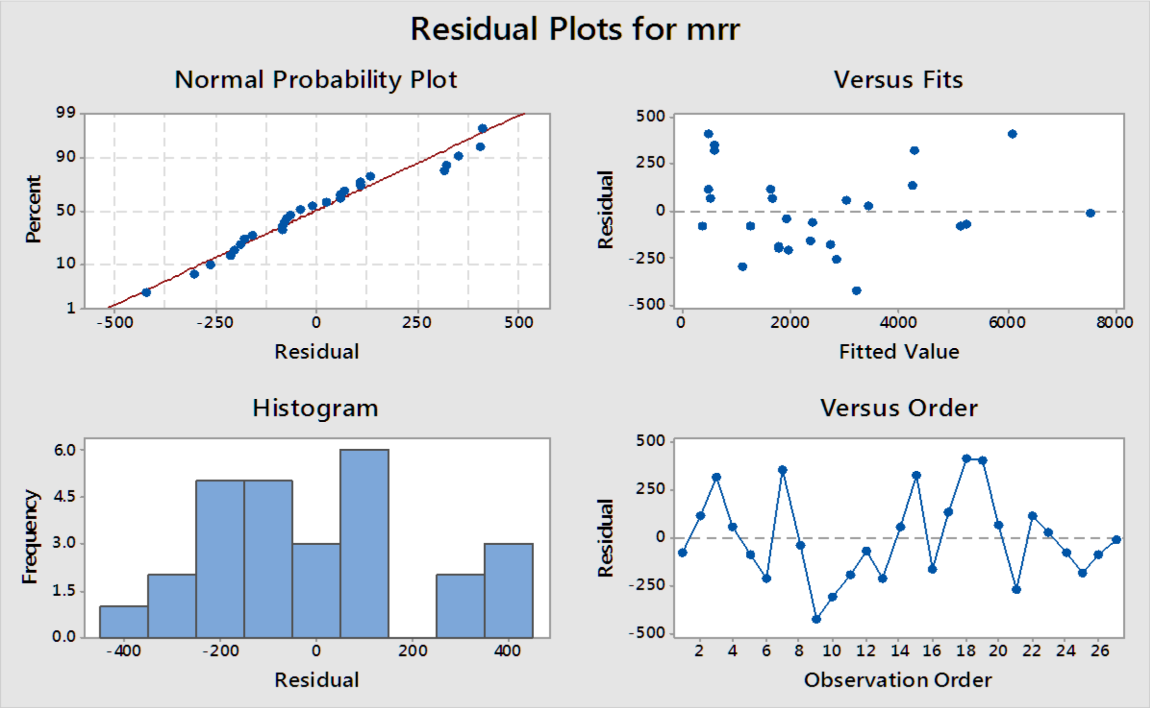


Figure 3.1 Residual plots of material removal rate

The residual plots through Minitab analysis for the MRR are depicted in Figure 3.1. The best subset regression analysis reveals that the feed and depth of cut combination shows the higher influencing factor combination which contributes 64.7 on the MRR.

IV. PARAMETRIC OPTIMISATION

The optimisation attempt in this investigation is sentenced in order to maximize the MRR so that improving the productivity. Process optimization is the order of adjusting a process so as to optimize a number of particular groups of parameters devoid of violating some constraint. This is one of the major concerns in all industrial decision making.

With the support of programming in the MATLAB R2017 software, an attempt is made in this paper for forecasting of the outcome variable referring to the input process variables with the optimization algorithms namely, Scatter Search Algorithm and Ant Colony Optimisation Algorithm. Forecasting of the optimized material removal rate in the turning process on the **AlMg1SiC composite alloy** specimen was performed on the primary objective as maximizing the outcome. To analyze the influence of the cutting speed and the feed on the MRR through MATLAB R2017 platform with the Elman Back Propagation approach is applied. The number of iterations initiated for this simulation is 50000 turns. The suitability of both the employed algorithms are assessed through the accuracy level in computation which is in the form mean squared error occurred rate as the indicator. The accuracy level of the computation is mentioned in the Table 4.1.

Table 4.1 Mean squared error value comparison

Algorithm	Mean squared error	Ranking
ACO	0.001681	1
SSA	0.006963	2

ACO algorithm converges with the minimum value of mean squared error than the SSA algorithm in this case. As the novel attempt is made by feeding the values off the SSA outcome as the input reference values to ACO and the performance of the simulation is evaluated.

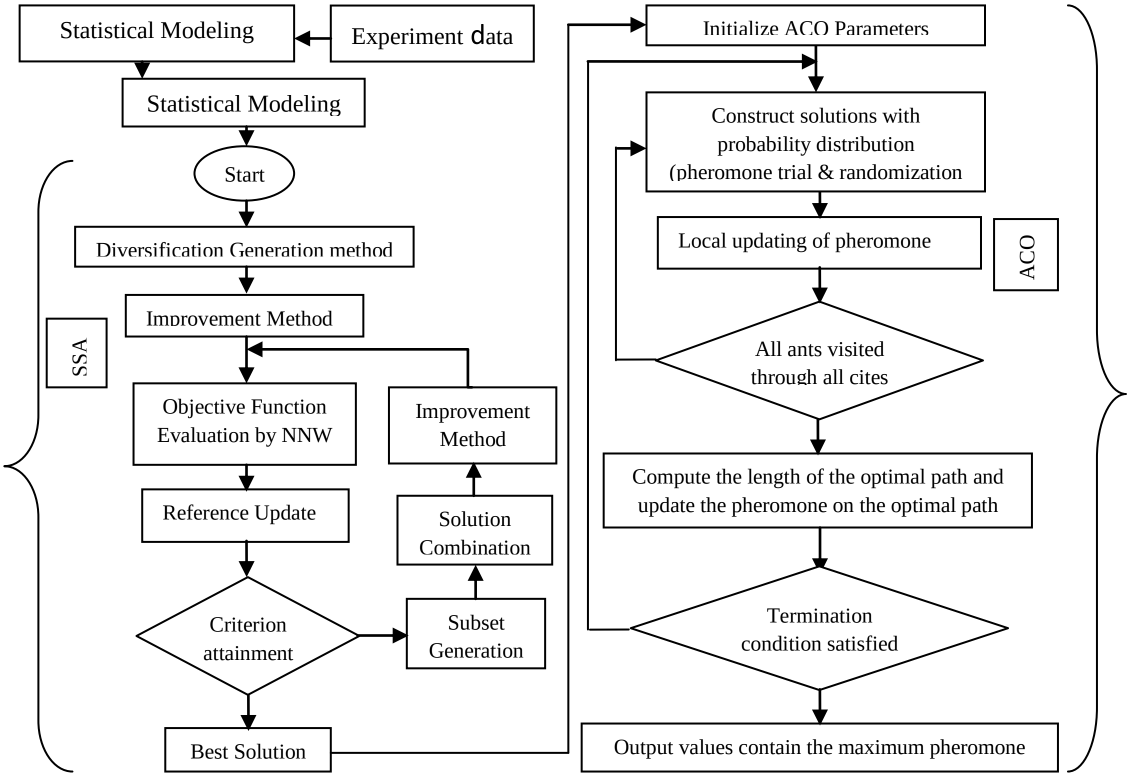


Figure 4.1 Block diagram of Hybridization

The value of the mean squared error was noticed as 0.001273, i.e. around 24.27 % improvement is noticed. The new approach of hybridization with regression equations as condition for simulation is shown in the Fig. 4.1. To draw a smooth curve with closer interval values of the process outcomes, the parameters selected was sub divided with the step value 105 rpm in speed, 0.0127 mm / rev step value in feed and 0.10 mm step value in depth of cut. The computed results of the MRR through this SSA feed ACO approach for all combination of the parameter input given to the programme are listed in the Table 4.2 to Table 4.9.

Table 4.2 MRR of Speed 280 (rpm) – Feed 0.0508, 0.0635, ... 0.1524 (mm / rev) Vs Depth of cut (mm)

Speed 280 rpm									
DOC	Feed 0.508	Feed 0.0635	Feed 0.0762	Feed 0.0889	Feed 0.1016	Feed 0.1143	Feed 0.127	Feed 0.1397	Feed 0.1524
0.40	306.071	926.750	914.741	888.837	844.408	775.874	677.055	581.086	368.471
0.50	415.601	1157.471	1223.641	1294.525	1364.920	1426.367	1467.341	1474.998	1439.070

0.60	896.080	1196.854	1275.010	1362.095	1455.003	1548.630	1636.015	1709.036	1759.901
0.70	1058.619	1224.467	1312.855	1415.355	1530.988	1656.719	1786.852	1912.943	2024.856
0.80	1128.564	1233.758	1321.233	1422.217	1535.874	1659.937	1790.448	1753.415	1915.609
0.90	1152.090	1231.045	1312.382	1404.989	1417.894	1630.775	1839.372	1826.807	1912.206
1.00	1147.914	1209.655	1276.497	1338.499	1426.670	1502.786	1572.004	1626.749	1659.046
1.10	1120.284	1159.888	1178.005	1238.895	1271.018	1290.540	1290.843	1266.603	1216.659
1.20	1062.208	1068.116	1067.316	1055.849	1029.684	986.100	925.380	852.646	778.865

Table 4.3 MRR of Speed 385 (rpm) – Feed 0.0508, 0.0635, ... 0.1524 (mm / rev) Vs Depth of cut (mm)

Speed 385 rpm									
DOC	Feed 0.5080	Feed 0.0635	Feed 0.0762	Feed 0.0889	Feed 0.1016	Feed 0.1143	Feed 0.1270	Feed 0.1397	Feed 0.1524
0.40	689.166	1023.270	1043.472	1053.635	954.758	1010.466	1061.893	883.718	754.271
0.50	1131.762	1301.454	1423.449	1561.296	1709.951	1860.188	1998.243	2106.679	2167.243
0.60	1232.658	1355.335	1486.107	1633.328	1793.552	1961.461	2130.197	2291.867	2438.193
0.70	1294.293	1427.873	1580.229	1755.349	1951.144	2163.226	2384.747	2606.735	2819.068
0.80	1344.955	1482.162	1641.182	1821.669	2021.242	2236.229	2461.939	2692.888	2922.884
0.90	1394.254	1537.105	1701.159	1769.940	2019.179	2264.138	2504.822	2741.230	2973.362
1.00	1440.530	1583.649	1650.245	1941.611	2228.700	2511.513	2462.474	2613.551	2728.569
1.10	1478.358	1613.200	1782.946	2112.166	2054.873	2181.898	2276.920	2326.017	2318.265
1.20	1495.865	1543.184	1717.821	1817.235	1892.432	1929.923	1918.594	1853.826	1741.647

Table 4.4 MRR of Speed 490 (rpm) – Feed 0.0508, 0.0635, ... 0.1524 (mm / rev) Vs Depth of cut (mm)

Speed 490 rpm									
DOC	Feed 0.5080	Feed 0.0635	Feed 0.0762	Feed 0.0889	Feed 0.1016	Feed 0.1143	Feed 0.1270	Feed 0.1397	Feed 0.1524
0.40	784.579	1013.712	1114.331	1210.677	1302.743	1213.609	1197.067	1151.599	1070.909
0.50	1200.154	1422.671	1598.446	1798.069	2015.209	2239.472	2456.465	2648.573	2796.788
0.60	1315.169	1481.072	1659.832	1860.051	2077.194	2305.502	2538.635	2769.952	2992.460
0.70	1410.578	1598.294	1810.452	2049.524	2309.655	2583.041	2861.033	3135.341	3399.028
0.80	1492.339	1548.932	1800.959	2048.707	2292.176	2531.369	2766.286	2996.927	3570.707
0.90	1581.653	1679.936	1969.815	2255.412	2536.736	2813.780	3086.546	3355.042	3619.254
1.00	1674.922	1809.821	2137.549	2461.000	2780.171	3095.072	3405.687	3712.033	3547.876
1.10	1769.686	1938.588	2304.166	2665.468	2700.481	2910.950	3084.395	3206.518	3264.214
1.20	1854.555	2066.234	2469.662	2468.557	2635.870	2756.422	2815.737	2804.138	2719.722

Table 4.5 MRR of Speed 595 (rpm) – Feed 0.0508, 0.0635, ... 0.1524 (mm / rev) Vs Depth of cut (mm)

Speed 595 rpm									
DOC	Feed 0.5080	Feed 0.0635	Feed 0.0762	Feed 0.0889	Feed 0.1016	Feed 0.1143	Feed 0.1270	Feed 0.1397	Feed 0.1524
0.40	811.698	1181.720	1314.423	1274.702	1323.377	1355.268	1367.859	1358.198	1322.205
0.50	1176.286	1515.193	1741.976	1997.944	2273.877	2557.220	2832.865	3084.218	3294.597
0.60	1306.713	1519.400	1727.803	1931.934	2131.789	2583.600	2871.088	3160.458	3445.604

0.70	1436.026	1686.557	1932.814	2174.796	2412.503	2931.879	3244.720	3546.130	3833.784
0.80	1564.214	1852.598	2136.710	2416.538	2692.095	2963.375	3230.373	3493.097	3751.549
0.90	1691.282	2017.519	2339.479	2657.160	2970.566	3279.697	3584.549	3885.126	4181.428
1.00	1817.232	2181.322	2541.132	2896.664	3247.922	3594.904	3937.606	4276.035	4610.184
1.10	1942.061	2344.000	2741.660	3135.050	3524.155	3473.968	3706.318	3889.585	4013.476
1.20	2065.773	2505.562	2941.074	2980.281	3219.771	3410.808	3542.178	3604.884	3592.713

Table 4.6 MRR of Speed 805 (rpm) – Feed 0.0508, 0.0635, ... 0.1524 (mm / rev) Vs Depth of cut (mm)

Speed 805 rpm									
DOC	Feed 0.5080	Feed 0.0635	Feed 0.0762	Feed 0.0889	Feed 0.1016	Feed 0.1143	Feed 0.1270	Feed 0.1397	Feed 0.1524
0.40	819.591	1266.559	1264.117	1364.204	1450.484	1523.745	1585.868	1637.876	1679.267
0.50	1264.792	1503.789	1738.513	2256.961	2626.172	2995.749	3347.388	3665.857	3939.796
0.60	1463.052	1739.899	2012.475	2280.772	2544.791	2804.536	3060.003	3708.634	4089.888
0.70	1660.186	1974.891	2285.315	2591.465	2893.336	3190.931	3484.253	4163.216	4478.329
0.80	1669.625	2208.760	2557.037	2901.036	3240.761	3576.209	3907.376	4234.270	4556.887
0.90	2051.109	2441.511	2827.642	3209.490	3587.064	3960.360	4329.382	4694.127	5054.595
1.00	2244.886	2673.142	3097.119	3516.825	3932.247	4343.395	4750.270	5152.863	5551.179
1.10	2437.547	2903.653	3365.484	3823.034	4276.311	4230.362	4547.491	4822.381	5053.879
1.20	2629.087	3133.042	3253.454	3639.090	3983.122	4281.214	4532.885	4735.279	4883.123

Table 4.7 MRR of Speed 910 (rpm) – Feed 0.0508, 0.0635, ... 0.1524 (mm / rev) Vs Depth of cut (mm)

Speed 910 rpm									
DOC	Feed 0.5080	Feed 0.0635	Feed 0.0762	Feed 0.0889	Feed 0.1016	Feed 0.1143	Feed 0.1270	Feed 0.1397	Feed 0.1524
0.40	805.720	1183.395	1250.007	1364.282	1465.678	1556.483	1640.400	1719.930	1795.840
0.50	1183.457	1454.541	1928.615	2309.090	2711.360	3112.096	3490.047	3829.532	4120.892
0.60	1415.633	1724.564	2029.226	2329.606	2625.710	2917.538	3205.092	3872.841	4290.921
0.70	1646.686	1993.472	2335.983	2674.216	3008.170	3337.849	4045.297	4396.975	4301.224
0.80	1660.157	2011.219	2641.617	3017.700	3389.509	3757.037	4120.290	4479.270	4833.970
0.90	1862.767	2264.835	2946.133	3360.068	3769.727	4175.107	4576.211	4973.041	5365.594
1.00	2044.023	2462.983	3249.529	3701.318	4148.824	4592.056	5031.015	5465.694	5896.095
1.10	2269.130	2713.343	3184.052	4041.445	4526.805	4467.111	4819.048	5130.731	5404.354
1.20	2492.664	2937.902	3391.220	3819.702	4204.814	4544.961	4844.129	5102.420	5316.211

Table 4.8 MRR of Speed 1015 (rpm) – Feed 0.0508, 0.0635, ... 0.1524 (mm / rev) Vs Depth of cut (mm)

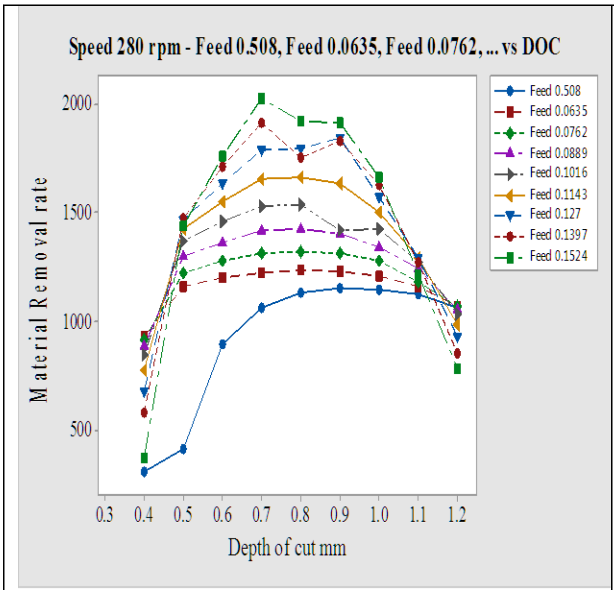
Speed 1015 rpm									
DOC	Feed 0.5080	Feed 0.0635	Feed 0.0762	Feed 0.0889	Feed 0.1016	Feed 0.1143	Feed 0.1270	Feed 0.1397	Feed 0.1524
0.40	751.189	1016.507	1277.546	1340.872	1453.650	1558.575	1660.888	1764.640	1871.807
0.50	1236.992	1573.518	1924.313	2321.530	2743.676	3166.262	3564.869	3921.640	4227.338
0.60	1284.490	1625.508	1962.248	2294.717	2622.904	2946.817	3266.453	3973.629	4421.704

0.70	1549.457	1928.328	2302.919	2673.237	3039.276	3791.423	4207.521	4580.212	4926.494
0.80	1813.306	2005.347	2642.473	3050.639	3454.530	3854.144	4249.483	4640.544	5027.328
0.90	1857.311	2274.240	2980.905	3426.921	3868.664	4306.130	4739.322	5168.233	5592.867
1.00	2047.150	2479.388	2964.362	3802.087	4281.677	4756.997	5228.036	5694.799	6157.282
1.10	2283.433	2745.725	3245.035	3739.409	4201.684	4624.792	5007.910	5352.635	5663.134
1.20	2519.673	2982.661	3461.658	3921.429	4340.260	4716.155	5055.396	5360.614	5629.735

Table 4.9 MRR of Speed 1120 (rpm) – Feed 0.0508, 0.0635, ... 0.1524 (mm / rev) Vs Depth of cut (mm)

	Speed 1120 rpm								
DOC	Feed 0.5080	Feed 0.0635	Feed 0.0762	Feed 0.0889	Feed 0.1016	Feed 0.1143	Feed 0.1270	Feed 0.1397	Feed 0.1524
0.40	751.189	1016.507	1277.546	1340.872	1453.650	1558.575	1660.888	1764.640	1871.807
0.50	1236.992	1573.518	1924.313	2321.530	2743.676	3166.262	3564.869	3921.640	4227.338
0.60	1284.490	1625.508	1962.248	2294.717	2622.904	2946.817	3266.453	3973.629	4421.704
0.70	1549.457	1928.328	2302.919	2673.237	3039.276	3791.423	4207.521	4580.212	4926.494
0.80	1813.306	2005.347	2642.473	3050.639	3454.530	3854.144	4249.483	4640.544	5027.328
0.90	1857.311	2274.240	2980.905	3426.921	3868.664	4306.130	4739.322	5168.233	5592.867
1.00	2047.150	2479.388	2964.362	3802.087	4281.677	4756.997	5228.036	5694.799	6157.282
1.10	2283.433	2745.725	3245.035	3739.409	4201.684	4624.792	5007.910	5352.635	5663.134
1.20	2519.673	2982.661	3461.658	3921.429	4340.260	4716.155	5055.396	5360.614	5629.735

The scatter plots generated through the Minitab for the above results are shown in the following Figures 4.2 to 4.5



Higher Productivity

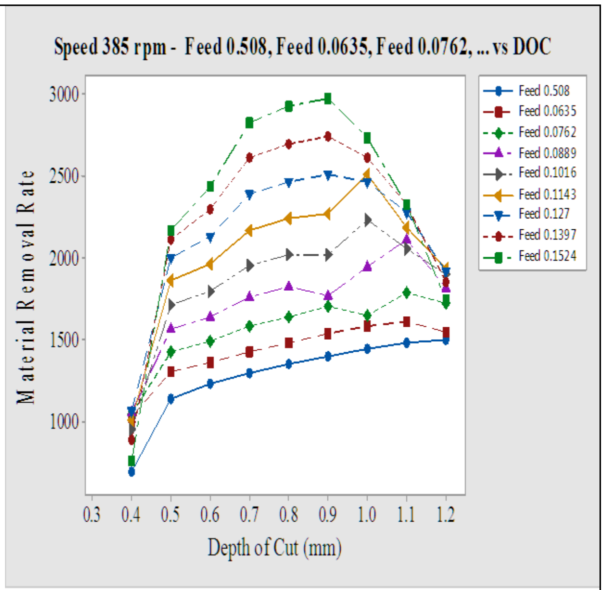


Fig. 4.2 Speed 280, 385 (rpm) – Feed 0.0508, 0.0635, 0.0762 ……..0.1524 (mm / rev) Vs Depth of cut (mm)

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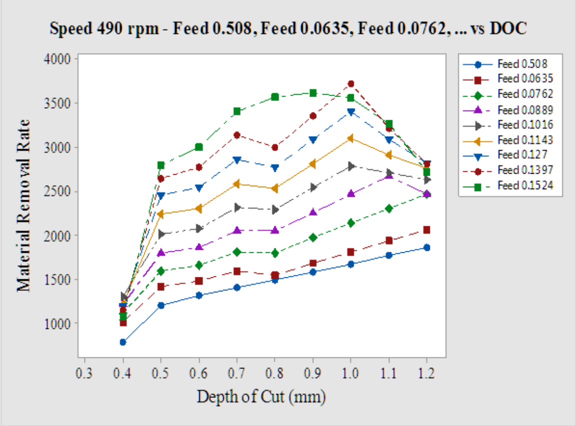


Higher Productivity

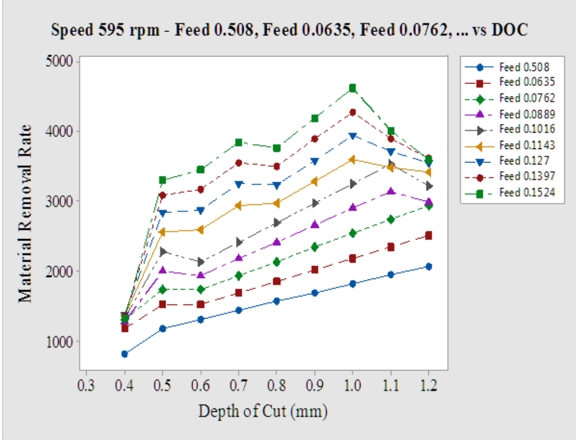
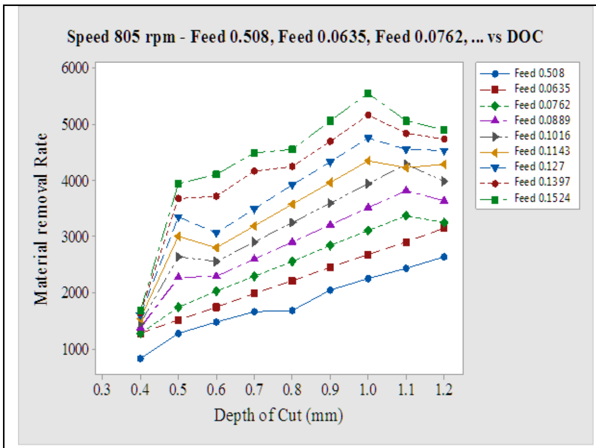


Fig. 4.3 Speed 490, 595 (rpm) – Feed 0.0508, 0.0635, 0.0762 ……..0.1524 (mm / rev) Vs Depth of cut (mm)



Higher Productivity

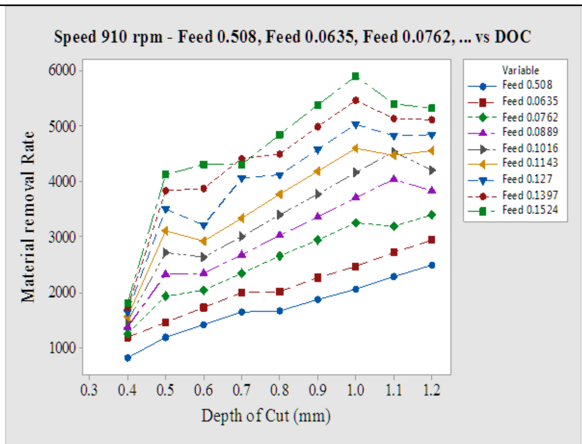
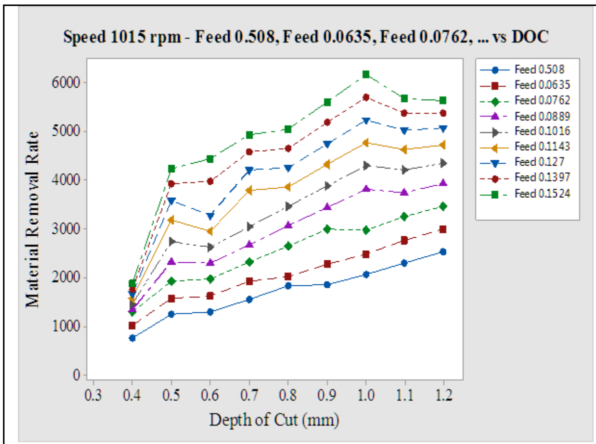


Fig. 4.4 Speed 805, 910 (rpm) – Feed 0.0508, 0.0635, 0.0762 ……..0.1524 (mm / rev) Vs Depth of cut (mm)



Higher Productivity

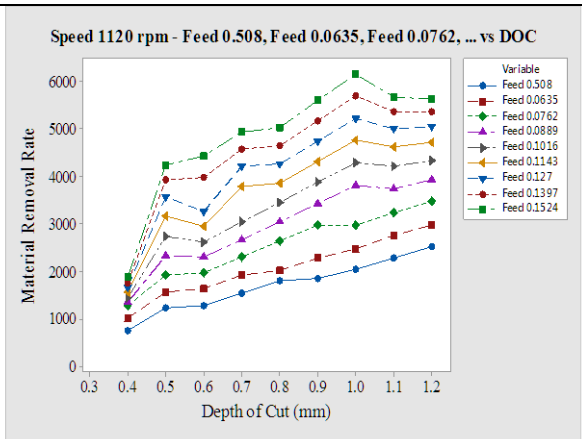


Fig. 4.5 Speed 1015, 1120 (rpm) – Feed 0.0508, 0.0635, 0.0762 ……..0.1524 (mm / rev) Vs Depth of cut (mm)

V. RESULTS AND CONCLUSIONS

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In this analytical investigation of the turning process on the AlMg1SiC composite alloy, for the set of experimental parameters with the selected level, 2^{nd} order regression relationship between the input, output variables is significant statistically. ACO Algorithm converges with minimum mean squared error value towards optimising than the Particle Swarm Optimisation. On replacing with the random process with regression relationship, feeding the regression computed values as input the accuracy level in computation is tuned to the finest level for the set of values. Feed and depth of cut combination shows the higher influencing factor combination which contributes 64.7 on the MRR. The optimum value of MRR is 6334.752 mm3 / min for the speed 1120 rpm, 0.1524 mm / rev feed, 1.0 mm depth of cut combination is the improved optimal value declared by Rahul Dhabale and Vijaykumar S Jatti [6] . Hence suggested that the manufacturers may also use this method of SSA feed ACO optimisation technique for simulating the outcome values and reference can be done at time of manufacturing products with the AlMg1SiC composite alloy.

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