Parametric Study on Lean Duplex Stainless Steel Channel Column Section

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Abstract - *Duplex stainless steels are a family of grades combining good corrosion resistance with high strength and ease of fabrication. Their physical properties are between those of the authentic and ferrite stainless steels but tend to be closer to those of the ferrites and to carbon steel. The chloride pitting and crevice corrosion resistance of the duplex stainless steels are a function of chromium, molybdenum, tungsten, and nitrogen content. They may be similar to those of type 316 or range above that of sea water stainless steels such as the 6% Mo austenitic steels. All duplex stainless steels have chloride stress corrosion cracking resistance significantly greater than that of the 3000 series authentic stainless steels. They all provide significantly greater strength than the authentic grades while exhibiting good ductility and toughness.*

***Key Words*:** lean duplex, channel section, finite element, ABAQUS, slenderness ratio.

1.INTRODUCTION

Duplex stainless steels, meaning those with a mixed microstructure of about equal proportions of austenite and ferrite, have existed for nearly 80 years. The early grades were alloys of chromium, nickel, and molybdenum. The first wrought duplex stainless steels were produced in Sweden in 1930 and were used in the sulfite paper industry. These grades were developed to reduce the intergranular corrosion problems in the early, high carbon austenitic stainless steels.

2. Body of Paper

Following are the aims and objectives of the dissertation work to assess the effect of
i) Cross section aspect ratio
ii) Slenderness ratio
iii) Ratio of corner radius to material thickness
on the strength of the lean duplex stainless steel channel column sections. To assess interaction of local and overall buckling in lean duplex stainless steel channel column sections. to compare values from finite element analysis based software, analytical values and experimental values of compressive strength of lean duplex stainless steel channel column sectionsThe body of the paper consists of numbered sections that present the main findings. These sections should be organized to best present the material. Preparing a part model For preparing a part model of castellated beam in ABAQUS we have to choose shape of the part as shell and of extrusion type. The pictorial view of part model of castellated beam along with loading and boundary conditions is shown in Fig.
Path: Create part - 3D space – Deformable – shell – Extrusion – CreatePath: Create material – Mechanical – Elasticity – Plasticity.

Path: Create section – Shell – Homogeneous – Thickness-Material Selection – section assignment

Assembly of model
Path: Create instance – Select part – Dependent Instance type – Ok.
Selection of type analysis
Path: Create step – Static general – continue – Time period (100) – Increments (fixed and max 100) – Increment size (1) – ok.

Test to study the effect of corner radius to material thickness ratio on the load carrying capacity of the LDSSCC section.

Sr.no	Section size	Corner radious tomatrial thikness ratio	Ultimate compressive load (kN)	
			Abaqus	Experimental
1	75 X 35X 2 L500 R3.17	1.58	105.1	99.60
2	75X 35 X 2 L500 R3.57	1.78	103	98.90
3	75X 35 X 2 L500 R3.96	1.98	99.8	96.5
4	75 X 35 X 2 L500 R4.36	2.18	98.5	95.44

Table -1: ultimate compressive load

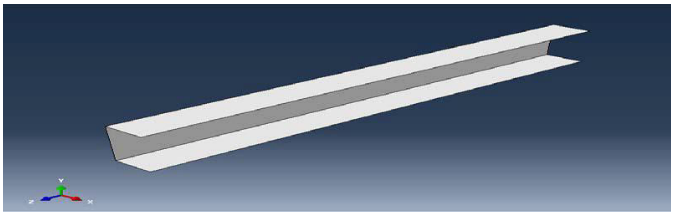
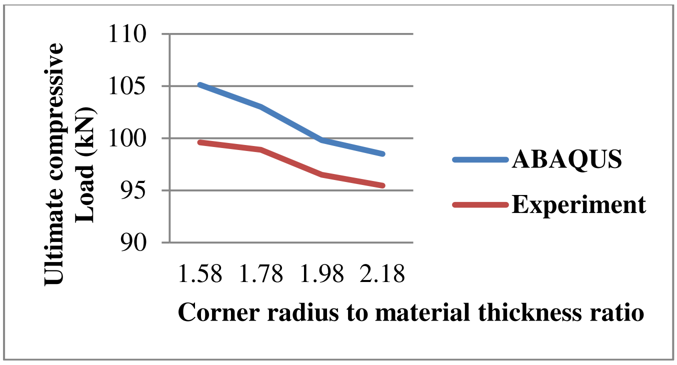


Fig -1: model in ABAQUS

Charts



3. CONCLUSIONS

Load carrying capacity of column decreases with increase in corner radius to material thickness ratio. Average 10% increase in corner radius to material thickness ratio results average 1.5% decrease in load carrying capacity.Lean duplex stainless steel channel column sections are subjected to local, distortional failure due to their smaller thickness. Under small load local and distortional buckling is observed in the web and then the buckling is observed in the flange also. The results obtained by finite element based software (ABAQUS) and experimental are compared with Euro Code get 9% difference in the value of ultimate compressive strength of a channel column sections.

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