

論文内容要旨

報告番号	甲 先 第 217 号	氏 名	Siti Nadiyah binti Mohd Saffe
学位論文題目	End Deformation After Cutting of Light Gauge Channel Steel Formed by Roll Forming (ロール成形された軽溝形鋼に生じる切り口変形)		
<p>内容要旨</p> <p>This thesis presents on the end deformation after cutting of light gauge channel steel formed by roll forming. The hat shape channel steel is broadly used as a sheet pile which is driven into the foundation for the deck plate of a building, roof material and sheathing or water stoppage, etc. This kind of channel steel is mainly fabricated by roll forming. When hat shape channel steel cut into specified length, the cutting mouth of the product will change by the release of residual stress. This change is generally called cut end deformation. If deformation at cutting mouth of the product is large, the size of a cutting mouth will become out of standard. This will result on joining failure when joining channel steel with other channel steel or channel steel with other components, since deformation arise to the mouth of the channel steel. Therefore, the process of amending the size of the mouth which cut end deformation occurs at front end and back end is needed. This will make production efficiency fall. Moreover, when carrying out flying cut, if a cutting mouth of product changes immediately after cutting, it will lead to cogs breakage. Development of the roll forming method which cut end deformation does not produce from the above is desired. Therefore, this thesis is focused to solve cut this problem by suggesting the improvement of fabrication of light gauge channel steel by roll forming.</p> <p>In this research, cut end deformation of hat shape channel steel and its mechanism was investigated by three-dimensional finite element simulation. The simulation is conducted using by transient elastic-plastic analysis by a static implicit method. First, 6 tandem of rolls, No.1-No.6 are built and 4 size of lips, 0mm, 9mm, 16mm and 23mm channel steel are formed by this rolls. Then, from simulation results, relation between simulation result and experimental result is compared.</p> <p>From the results, channel steel with lip having opening deformation at both front and back end. However, channel steel without lip having closing deformation at the front, and opening deformation at back end. During roll forming process, concave, convex and reverse bending deformation on flange take effect and make bending lines diverge from contact point between top roll and corner of flange. The reverse bending deformation is caused by bending moment and twisting moment. These moments remain on the flange. When channel steel is cut, release of the bending moment results on opening on both front end and back end. At that moment, release of twisting moment makes the flange closing at the front end and opening at the back end.</p> <p>Inner rolls at the end of the finale tandem are proposed. Previously, by performing a finite element simulation of the cutting process and the roll-forming process of the channel steel, the residual shear stress in the inner layer are in different directions at the inner and outer layer which is the factor of the occurrence of cut end deformation which result in opening at the back end and closing at the tail end. In the experiments, the result shown that an inner side roll has an effect in cut end deformation, and drum type inner roll is more effective. For this reason, inserting inner rolls at the finale tandem was applied on channel steel and simulation on it was done. As a finishing process after fabrication of a product, the No.7 outer roll and No.8 inner roll were attached. Therefore, this chapter will verify the methode to eliminate cut end deformation by applying a small inner roll at finale tandem of the roll forming process. In this research, finite element method (FEM) is used and the mechanism of the cut end deformation by inserting inner roll will be discussed. Result shows that inserting inner rolls at the end of the finale tandem could eliminate cut end deformation.</p>			

論文審査の結果の要旨

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学位論文題目 End Deformation After Cutting of Light Gauge Channel Steel Formed by Roll Forming (ロール成形された軽溝形鋼に生じる切り口変形)			
審査結果の要旨 <p>軽溝形鋼は主としてロールフォーミングによって製造され、建築構造用部材などに使用される。軽溝形鋼が切断される時、残留応力の解放により切断口が変形する。この変形を切り口変形と呼ぶ。実験により、チャンネル材の切断面は、先端は閉じて後端は開くこと、ハット形鋼では、先端および後端ともに開くことが明らかにされた。そして、3次元有限要素シミュレーションにより、チャンネル材およびハット形鋼の切口変形とその発生メカニズムについて調査された。チャンネル材、ハット形鋼に生じる残留応力（長手方向応力、長手-横断線方向せん断応力）が算出され、長手方向応力は長手方向曲げモーメントの残留に置き換えることができること、長手-横断線方向せん断応力の残留はねじりモーメントの残留に置き換えることができることが説明された。そして、切断時に曲げモーメントの解放により両端が開く変形が起きること、ねじりモーメントの解放により先端は閉じて後端は開く変形が起こることが明らかにされた。以上の考察から、傾斜アウターロールと太鼓型インナーロールを用いた仕上げ成形により、切口変形を改善する成形法が提案され、シミュレーションによりその効果が説明されている。</p> <p>以上本研究は、実製造現場で問題となっている軽溝形鋼の切口変形の形状不良の発生が理論的に説明されている。また、切口変形を改善する成形法が提案され、創意と工夫が認められる。このことは、今後の設計基準の確立に大きく資するものと考えられ、本論文は博士（工学）の学位授与に値するものと判定する。</p> <p>なお、本論文の審査には、長町拓夫准教授の協力を得た。</p>			