Solid Edge 3D Model of Synthesized In-Line Ten Link Gear Slider Variable Topology Mechanism

H. M. Naveen[1], Shrinivas S. Balli[2] and Umesh M. Daivagna[3]

[1] Assistant Professor, Department of Mechanical Engineering, RYM Engineering College, Ballari, Karnataka, India
[2]Professor, Department of Mechanical Engineering, Basaveshwar Engineering College, Bagalkot, Karnataka, India
[3] Professor, Department of Mechanical Engineering, Ballari Institute of Technology, Ballari, Karnataka, India

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Abstract- *The paper showcases a 3D model of synthesized in-line ten link gear slider variable topology mechanism. The synthesized planar mechanism will be modeled initially considering only one plane and then another parallel plane is considered to develop a parallel mechanism concept. This creates a platform in which two mechanisms in two parallel planes work on single input provided at any parallel plane. Solid Edge software will be considered in the process of model creation. The presentation helps the designer to visualize how practically a mechanism can look virtually when fabricated.*

Key Words: **Variable Topology Mechanism, Solid Edge 3D Model, Ten Link Gear Slider**

1. INTRODUCTION

Solid Edge is a software platform where in, the synthesized mechanism can be developed such that the complete mechanism can be visualized virtually. This is a Computer Aided Design (CAD) program used for modeling of mechanisms, create drawings and animate the mechanism. The accessibility provided by the software helps to create required dimensional changes in the model. The fundamental aspect in kinematics is synthesis of mechanism. Synthesis can be classified as dimensional, type and number synthesis to perform various the tasks. Synthesis and Analysis are the two major categories of design process of mechanism. Synthesis process involves devising a mechanism to perform the desired task and analysis process involves functioning of the mechanism. When a mechanism is synthesized with some parameters, virtual model of the mechanism is built to study its working aspects. As complexity arises in building the real mechanism and testing, this calls for software based study of the mechanisms.

2. LITERATURE REVIEW

This text summarizes the literature review on variable topology mechanism and suggests the approach adapted by different people working in this area. Balli and Chand [1] intimated that, an analytical method can be used to synthesize five bar mechanism with variable topology. The work was carried out for movement between extreme positions of the mechanism for function generation. Balli and Chand [2] proposed the complex number method and utilized it to synthesize the mechanism having five links for motion and path generation tasks with variable topology for movement between extreme positions. Balli and Chand [3] suggested an analytical method to synthesize planar seven link mechanism with variable topology for motion between two dead centers. G. M. Gadad, Umesh M. Daivagna and Shrinivas S. Balli [4] focused on synthesis of planar seven link mechanism using triad and dyad with variable topology for the task function generation. Daivagna and Balli [5] dealt with synthesis process of an off-set five link slider mechanism with variable topology. Ren-Chung Soong, Kuei-Shu Hsu and Feng-Tsai Weng [6] applied a geared seven-bar mechanism for mechanical forming presses. Daivagna and Balli [7] synthesized a variable topology seven-bar slider mechanism to have motion between two dead-center positions. Volken Parlaktas, Eres Soylemez and Engin Tanik [8] presented an analysis and synthesis method for a geared four-bar mechanism. Daivagna and Balli [9] worked on the synthesis of variable topology mechanism with five-bar slider for finitely separated positions. Prashant and Balli [10] reviewed the works on variable topology method. H. M. Naveen, Shrinivas S. Balli and Umesh M. Daivagna [11] dealt with synthesis of eight link gear mechanism for motion generation. H. M. Naveen, Shrinivas S. Balli and Umesh M. Daivagna [12] dealt with synthesis of In-Line Ten Link Gear Slider Mechanism of Variable Topology. Prashant and Balli [13] synthesized a seven bar slider for limiting positions using variable topology. H. M. Naveen, Shrinivas S. Balli and Umesh M. Daivagna [14] presented the behavior of mechanism using linkage software. H. M. Naveen, Shrinivas S. Balli and Umesh M. Daivagna [15] dealt with the functional aspects of ten link gear slider mechanism. H. M. Naveen, Shrinivas S. Balli and Umesh M. Daivagna [16] worked on Phase III operating conditions in variable topology mechanism. H. M. Naveen, Shrinivas S. Balli and Umesh M. Daivagna [17] worked on alternative approaches in variable topology mechanisms. H. M. Naveen, Shrinivas S. Balli and Umesh M. Daivagna [18] dealt with transmission angles in synthesized eight link gear variable topology mechanism. H. M. Naveen, Shrinivas S. Balli and Umesh M. Daivagna [19] presented the 3D model of synthesized eight link gear variable topology mechanism.

3. MODELING OF SYNTHESIZED IN-LINE TEN LINK GEAR SLIDER VARIABLE TOPOLOGY MECHANISM

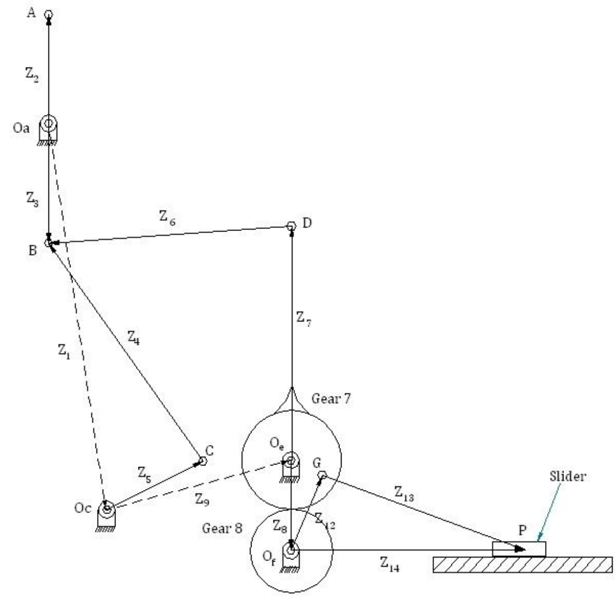

Fig. 1 Synthesized In-Line Ten Link Gear Slider Variable Topology Mechanism

The fig. 1 represents synthesized in-line ten link gear slider mechanism. The synthesis process is dealt with and the determined dimensions of the mechanism are considered in the modeling process of the mechanism using solid Edge software [12].

Thus, the determined parameters of in-line ten link gear slider mechanism are,
$|Z_1| = O_aO_c = 137.5$ mm
$|Z_2| = O_aA = 38$ mm
$|Z_3| = AB = 80.1$ mm
$|Z_4| = CB = 92.0$ mm
$|Z_5| = O_cC = 35.4$ mm
$|Z_6| = DB = 85.3$ mm
$|Z_7| = O_eD = 82$ mm
$|Z_8| = O_fO_e = 32$ mm
$|Z_9| = O_cO_f = 69.0$ mm
$|Z_{12}| = O_fG = 22.5$ mm
$|Z_{13}| = GP = 64.3$ mm
$|Z_{14}| = O_fP = 62$ mm
$|P_{12}| = P_1P_2 = 18$ mm

3.1 Modeling of Synthesized In-Line Ten Link Gear Slider Variable Topology Mechanism in Single Plane

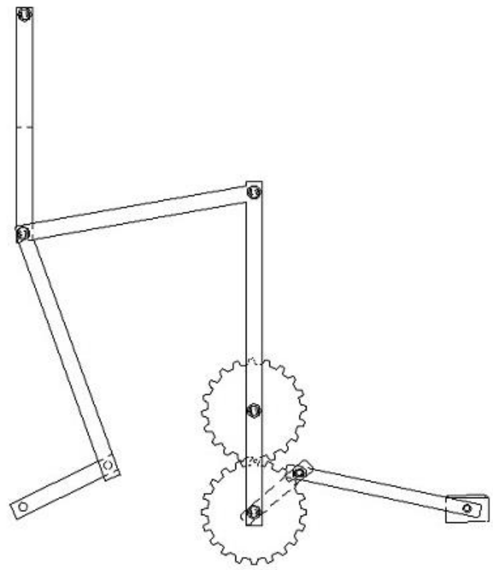

Fig. 2 Synthesized In-Line Ten Link Gear Slider Mechanism Model in Solid Edge in 2D Representation

The fig. 2 represents the modeling of the synthesized in-line ten link gear slider mechanism in solid edge software in two dimensions. This pictorial view resembles the mechanism which will be used in positioning of the links and orientation of the mechanism.

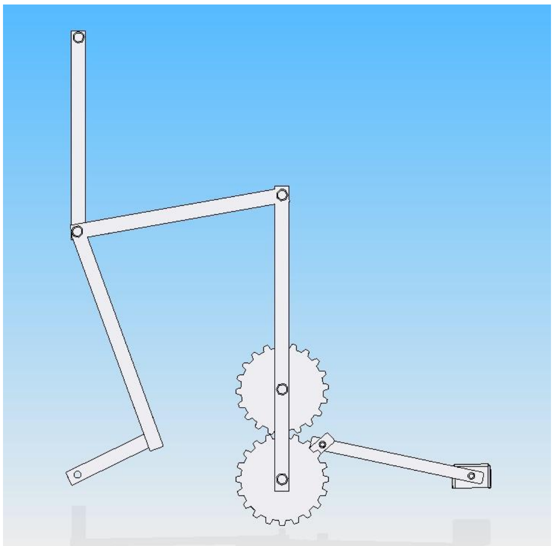

Fig. 3 Synthesized In-Line Ten Link Gear Slider Mechanism Model in Solid Edge in Front View Representation

The fig. 3 shows the model of the synthesized in-line ten link gear slider mechanism in solid edge software in two dimensions. This pictorial view represents the solid view of the mechanism and aids to the look of solid links used in manufacturing the mechanism. The solid view can be considered to be made of materials like cast iron, aluminum, composites or wood as per the choice of the designer.

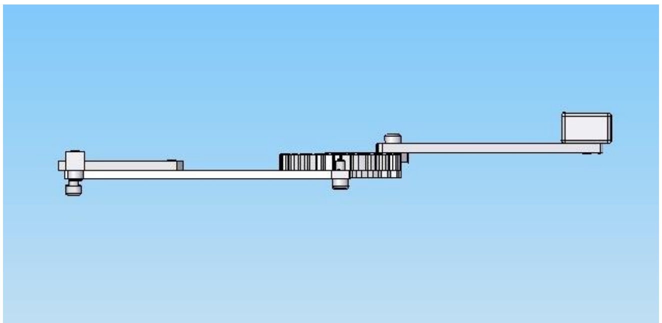

Fig. 4 Synthesized In-Line Ten Link Gear Slider Mechanism Model in Solid Edge in Top View Representation

The fig. 4 shows the model of the synthesized in-line ten link gear slider mechanism in solid edge software in top view. This pictorial view represents the solid view of the mechanism and aids to the look of mechanism from top and its orientation.

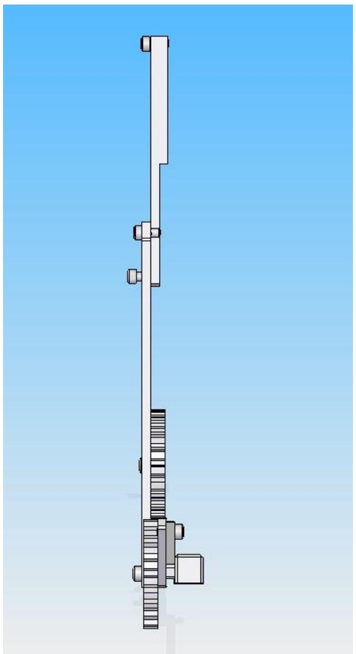

Fig. 5 Synthesized In-Line Ten Link Gear Slider Mechanism Model in Solid Edge in Side View Representation

The fig. 5 shows the model of the synthesized in-line ten link gear slider mechanism in solid edge software in side view. This pictorial view represents the solid view of the mechanism and aids to the look of mechanism from side view and its orientation.

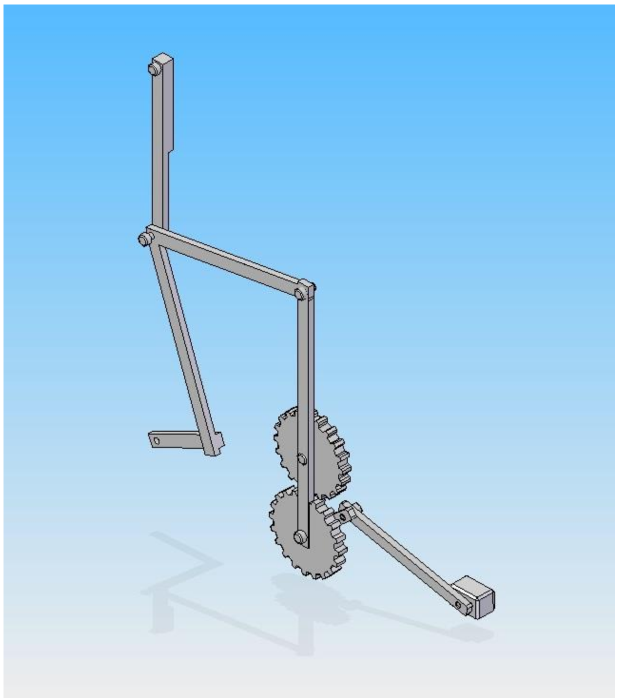

Fig. 6 Synthesized In-Line Ten Link Gear Slider Mechanism Model in Solid Edge in Isometric Representation

The fig. 6 represents the model of the synthesized in-line ten link gear slider mechanism in solid edge software in isometric view. This pictorial view represents the solid view of the mechanism and aids to the look of mechanism in three dimensions. This is one of the most useful view in which the complete assembly of the linkage can be seen and the study can be extended on the same.

3.2 Modeling of Synthesized In-Line Ten Link Gear Slider Variable Topology Mechanism in Two Parallel Planes

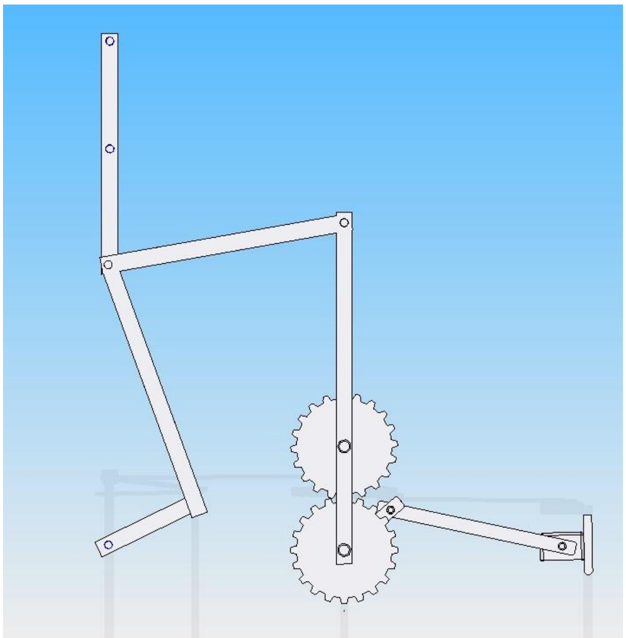

Fig. 7 Synthesized In-Line Ten Link Gear Slider Mechanism Model in Two Parallel Planes and Front View Representation in Solid Edge

As represented in fig. 6 the synthesized mechanism is designed on a single plane and all the links lie on the same plane, hence it is named as a planar mechanism. If a plane parallel to the considered plane is assumed to have the replica of the same mechanism, then the two mechanisms on two parallel planes can be connected by a single shaft at revolute joints. This assembly of the mechanisms can be made to run by motors connected at inputs as defined by cranks, on one plane or different planes. This assembly is shown in fig. 7 in the form of front view of the mechanism assembly.

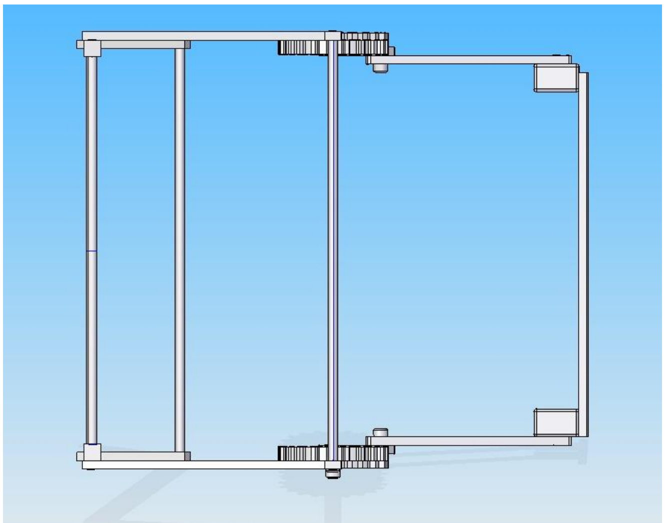

Fig. 8 Synthesized In-Line Ten Link Gear Slider Mechanism Model in Two Parallel Planes and Top View Representation in Solid Edge

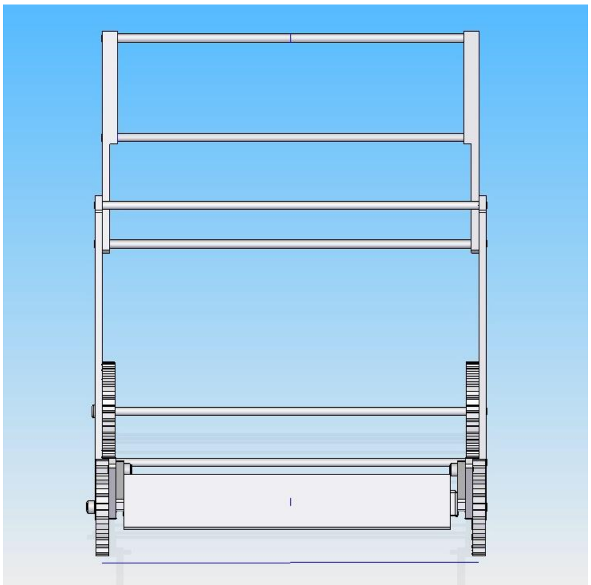

Fig. 9 Synthesized In-Line Ten Link Gear Slider Mechanism Model in Two Parallel Planes and Side View Representation in Solid Edge

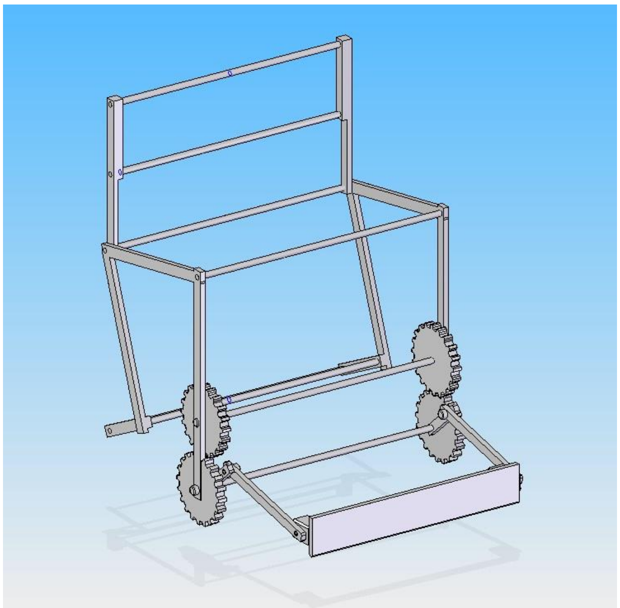

Fig. 10 Synthesized In-Line Ten Link Gear Slider Mechanism Model in Two Parallel Planes and Isometric Representation in Solid Edge

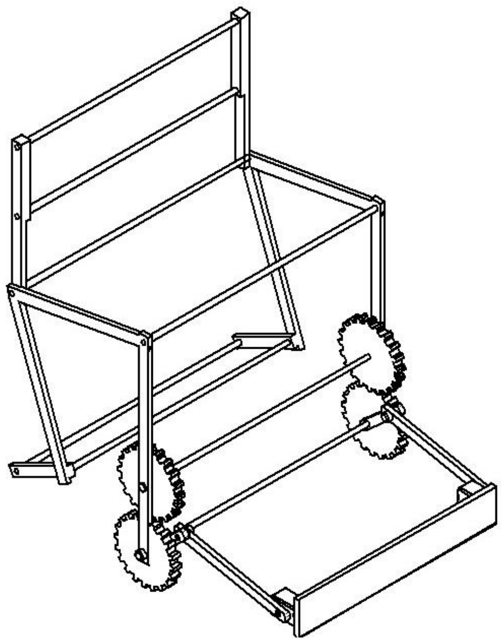

Fig. 11 Synthesized In-Line Ten Link Gear Slider Mechanism Model in Two Parallel Planes and Wire Frame Representation in Solid Edge

4. FUTURE PERSPECTIVE OF MODELING THE SYNTHESIZED MECHANISM IN SOLID EDGE

The present paper on solid edge 3D model of synthesized in-line ten link gear slider mechanism with variable topology explains clearly that, a mechanism synthesized can be modeled in solid edge software to create different views of the design. Thus the models created can be exported to any of the analysis and simulation aspects and the work can be extended. The isometric view provides an insight among the design engineers so as to apply the parallel plane mechanism assembly to any of the existing earth moving equipments to carry out various tasks.

5. CONCLUSION

A study of modeling aspects of synthesized in-line ten link gear slider mechanism with variable topology with the aid of solid edge software predicts that, any synthesized mechanism can be taken into consideration for modeling. The parallel mechanism model shows that the slider of the mechanism can be connected by a loader and scrapper like structure to perform various operations like chopping and pushing of any material. This complete mechanism can be attached to front portion of the tractor to perform in agricultural sector. In order to visualize the working condition of the mechanism simulation can also be considered. The pictorial prediction of characteristics helps any designer to verify the observations and to develop a perfect operating mechanism.

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BIOGRAPHIES

H. M. Naveen, is serving as Assistant Professor, in Department of Mechanical Engineering, RYM Engineering College, Ballari since 2014.

Dr. Shrinivas S. Balli, has his Doctoral Degree from Allahabad University. He has published more than 22 Research Articles in International Journals/Conferences. He has Academic and Research experience of 30 years and currently serving as Professor at Mechanical Engineering, BEC, Bagalkot.

Dr. Umesh M. Daivagna, has his Doctoral Degree from VTU. He has published many Research Articles in International Journals/Conferences. He has Academic and Research experience of 25 years and currently serving as Professor, Mechanical Engineering, BITM, Ballari.