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Development of Slider Crank Mechanism: A Review

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Abstract: A slider-crank is a four-bar linkage that has a crank that rotates coupled to a slider that the moves along a straight line. This mechanism is composed of three important parts: The crank which is the rotating disc, the slider which slides inside the tube and the connecting rod which joins the parts together The purpose of this study is to simulate of the slider-crank mechanism. This mechanism is found in: compressor, feeder, pump, injector, water mill, crusher, etc. Besides, the crank-slide linkage is central to diesel, on steam engine or gasoline internal combustion engines, which play an indispensable role in modern living. This system consists of the following components. The Slider crank mechanism is a specific bar link configuration that exhibits simultaneous rotation and rectilinear motion. This mechanism is often used to study the kinematics of machines and dynamic forces. The position, speed, acceleration and recoil generated by the sliding shaft mechanism during

Keywords: feeder, slider

I. INTRODUCTION

slider-crank mechanism, arrangement of mechanical parts designed to convert straight-line motion to rotary motion, as in a reciprocating piston engine, or to convert rotary motion to straight-line motion, as in a reciprocating piston pump. The basic nature of the mechanism and the relative motion of the parts can best be described with the aid of the accompanying figure, in which the moving parts are lightly shaded. The darkly shaded part 1, the fixed frame or block of the pump or engine, contains a cylinder, depicted in cross section by its walls DE and FG, in which the piston, part 4, slides back and forth.

The small circle at A represents the main crankshaft bearing, which is also in part 1. The crankshaft, part 2, is shown as a straight member extending from the main bearing at A to the crankpin bearing at B, which connects it to the connecting rod, part 3. The connecting rod is shown as a straight member extending from the crankpin bearing at B to the wristpin bearing at C, which connects it to the piston, part 4, which is shown as a rectangle. The three bearings shown as circles at A, B, and C permit the connected members to rotate freely with respect to one another. The path of B is a circle of radius AB; when B is at point h the piston will be in position H, and when B is at point j the piston will be in position J. On a gasoline engine, the head end of the cylinder (where the explosion of the gasoline-air mixture takes place) is at EG; the pressure produced by the explosion will push the piston from position H to position J; return motion from J to H will require the rotational energy of a flywheel attached to the crankshaft and rotating about a bearing collinear with bearing A. On a reciprocating piston pump the crankshaft would be driven by a motor.

II. LITERATURE REVIEW

1. Norton, R.L. (2009). Kinematics and Dynamics of Machinery. McGraw-Hill.

2. Shigley, J.E., Uicker, J.J. (2017). Theory of Machines and Mechanisms. Oxford University Press.

3. Norton, R.L. (2012). Design of Machinery. McGraw-Hill.

4. Nigus, H. (2015). "Kinematics and Load Formulation of Engine Crank Mechanism." Mechanics, Materials Science & Engineering Journal.

5. De Groote, W., et al. (2019). "Neural Network Augmented Physics Models for Systems with Partially Unknown Dynamics: Application to Slider-Crank Mechanism." arXiv preprint arXiv:1910.12212.

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III. PROBLEM DEFINITION

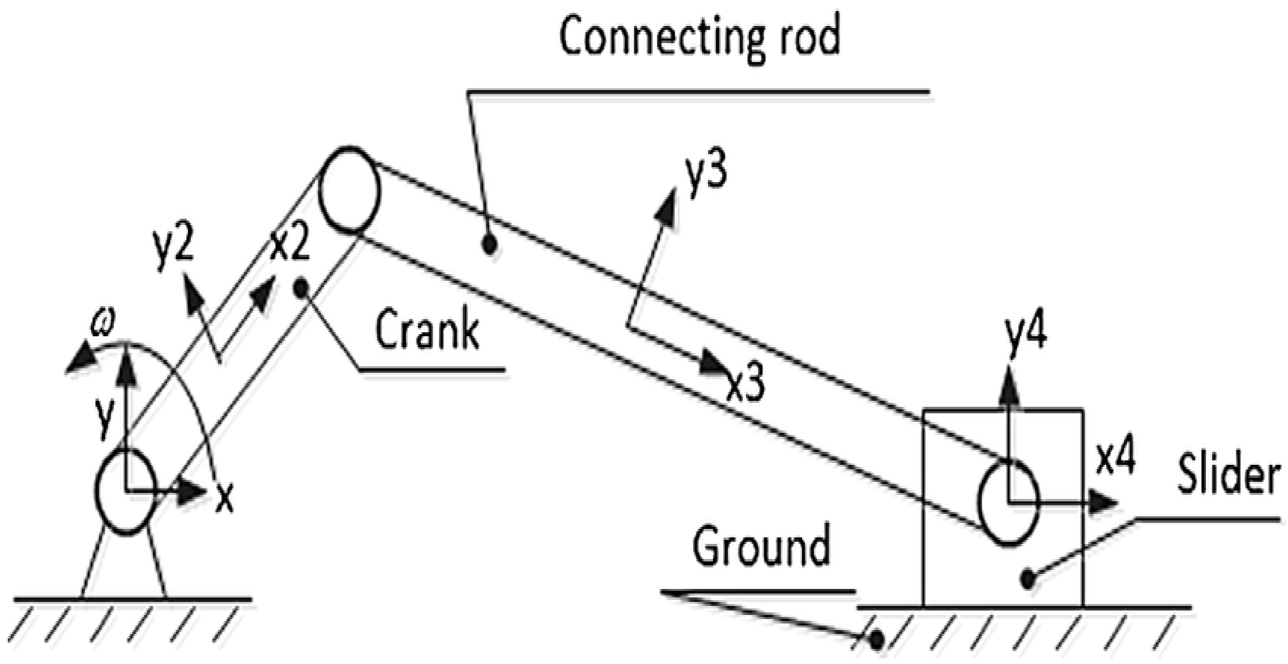
The slider-crank mechanism is a fundamental system used in various engineering applications, such as internal combustion engines, compressors, and industrial machines. Understanding its kinematics and dynamics is crucial for students and researchers. However, many academic institutions lack a dedicated lab setup that allows hands-on experimentation with this mechanism. The absence of such a setup leads to a gap between theoretical learning and practical application, making it difficult for students to visualize and analyze real-world mechanical motion

The purpose of this project is to develop a lab-scale slider-crank mechanism to enable experimental analysis of its motion characteristics. The mechanism will help students and researchers:

Visualize Motion: Understand the conversion of rotary motion into reciprocating motion.
Analyze Kinematics: Measure displacement, velocity, and acceleration of different components.
Study Forces & Dynamics: Examine the forces acting on the crank, slider, and connecting rod
Compare with Theory: Validate theoretical equations with experimental data.
Compare with Theory: Validate theoretical equations with experimental data

To avoid confusion, the family name must be written as the last part of each author name (e.g. John A.K. Smith). Each affiliation must include, at the very least, the name of the company and the name of the country where the author is based (e.g. Causal Productions Pty Ltd, Australia).

IV. PROPOSED LAYOUT



V. COMPONENTS OF SYSTEM

A slider crank mechanism primarily consists of three key components: a crank (rotating element), a connecting rod (connecting the crank to the slider), and a slider (the linear moving element) which slides along a fixed guide, essentially converting rotary motion from the crank into linear reciprocating motion from the slider; all these components are considered as links within the mechanism.

Breakdown of the components
1)Crank: This is the rotating shaft with an offset crank pin, which provides the input power to the mechanism by rotating around a fixed pivot point.

2)Connecting Rod: A rigid bar that connects the crank pin to the slider, allowing for the transmission of motion between the rotating crank and the sliding slider.

3)Slider: The linear moving element that slides along a fixed guide, representing the output motion of the mechanism.

Key points about the slider crank mechanism:

1 (Function: It is primarily used to convert rotary motion into linear motion, making it a fundamental component in applications like internal combustion engines, pumps, compressors, and various machinery.

2) Degree of freedom: A simple slider crank mechanism has one degree of freedom, meaning that the system can move in a single defined way when the crank is rotated.

3) Inversions:By fixing different links within the mechanism, different variations of the slider crank can be achieved, like the quick return mechanism.

VI. METHODOLOGY

A slider-crank mechanism methodology involves analyzing and designing a mechanical system that converts rotational motion from a rotating crank into linear motion via a sliding slider, using a connecting rod to link the two components, essentially transforming circular movement into reciprocating motion; commonly used in applications like internal combustion engines, pumps, and compressors, where a piston needs to move linearly within a cylinder.

Crank: The rotating part, typically a circular disc attached to a shaft, which initiates the motion.

Connecting rod: A rigid link connecting the crank to the slider, allowing for smooth transfer of motion between the two

Slider: The part that moves linearly along a fixed guide, usually within a cylinder or guideway.

Advantages

1. High efficiency: The mechanism efficiently converts rotary motion to linear motion with minimal energy loss.

2. Reliable performance: It provides consistent motion transfer, which is critical in engines and industrial applications.

3. Easy maintenance: Due to its simple construction, maintenance and repairs are straightforward.

4. High torque transmission: The mechanism can handle high torque, making it suitable for heavy-duty applications.

5. Customizability: The length of the crank and connecting rod can be adjusted to achieve desired motion characteristics.

6. Reversibility: The mechanism can work in both forward and reverse directions.

Disadvantages

1. Friction losses: The sliding motion results in frictional losses, reducing overall efficiency.

2. Lubrication requirement: Continuous lubrication is needed to reduce wear and tear.

3. Heat generation: The sliding parts generate heat, requiring cooling or heat dissipation methods.

4. Limited stroke length: The movement is constrained by the crank's dimensions, limiting the range of motion.

5. Noise and vibrations: The impact of moving parts can generate noise and unwanted vibrations, requiring damping solutions.

6. Manufacturing complexity: While simple in principle, achieving precise tolerances in components can be challenging.

Application

Internal combustion engines
The piston's reciprocating motion is converted to rotary motion at the crank by the connecting rod.

Piston compressors and pumps
The rotary motion of the crankshaft is converted into linear motion by the slider-crank mechanism.

Shaping machines
The double slider-crank mechanism is used in shaping machines to create precise reciprocating linear motion.

VII. CONCLUSION

The purpose of this paper is to show the correlation between research and multi-body model findings concerning angular and linear velocities and slider and coupler connections acceleration of an up-sided down slider crank framework. In this case, the results tend to be rather reasonable to support the proposed multi body model. In this case, the connector ties are shown at the limit positions (minimum and maximum) and the corresponding angle. This research represents the first way of creating an analytical and multi-body model that is more Macpherson-friendly. The dynamic function of a versatile rod slider cabling system is studied.

The rotational movement is transformed into a reciprocal movement by a revolving column, a connecting rod

REFERENCES

[1]. Norton, R.L. (2009). Kinematics and Dynamics of Machinery. McGraw-Hill.
[2]. Shigley, J.E., Uicker, J.J. (2017). Theory of Machines and Mechanisms. Oxford University Press.
[3]. Norton, R.L. (2012). Design of Machinery. McGraw-Hill.
[4]. Nigus, H. (2015). "Kinematics and Load Formulation of Engine Crank Mechanism." Mechanics, Materials Science & Engineering Journal.
[5]. De Groote, W., et al. (2019). "Neural Network Augmented Physics Models for Systems with Partially Unknown Dynamics: Application to Slider-Crank Mechanism." arXiv preprint arXiv:1910.12212.