Four-bar Linkage Synthesis for A Combination of Motion and Path-point Generation

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**Objective:** To develop techniques that address the design of planar four-bar linkages for tasks common to pick-and-place devices, common in assembly and manufacturing operations.

**Introduction**
- Pick-and-place machines are mechanical devices designed to repetitively perform a specific sequence of part movements

**Numerical Methodology**
- Numerical methods formulate the kinematic chain constraint equations and solve for the appropriate link lengths and pivot locations.

**Examples**
- Combination have finite solutions: 4 positions and 2 points
- Combination have 1-parameter solutions: 3 positions and 3 points

**GCP Methodology**
- Geometric Constraint Programming (GCP) is a technique that has the advantages of both the graphical and analytical techniques for the kinematic synthesis

**System Equations**

\[
L_{11}I_{11} - L_{11}L_{11} = 0 \\
L_{21}I_{21} - L_{21}L_{21} = 0 \\
i = 2, 3, 4, 5, 6.
\]

**Conclusion**
- Techniques developed to design planar four-bar linkages for tasks common to pick-and-place devices.