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Ingenuity for life

SIMOCRANE Sway Control for STS

High productivity and
maximized safety

[siemens.com/cranes](https://www.siemens.com/cranes)

Quick and precise positioning, safe and stable operations

Innovative technology enhancing productivity and safety

Prevent Load Collision in Manual Mode

Crane operators must be focused when performing their work assignments in order to operate safely and quickly. The Siemens Cranes "Soft Approach" function assists crane operators minimizing risks of collision in manual operation. The system supports Hoist to perform soft-landing as well as for trolley to achieve smart- slow-down. Depending on fixed or variable obstacle, crane will either stop in front of a mechanical structure or move softly to a next adjacent container.

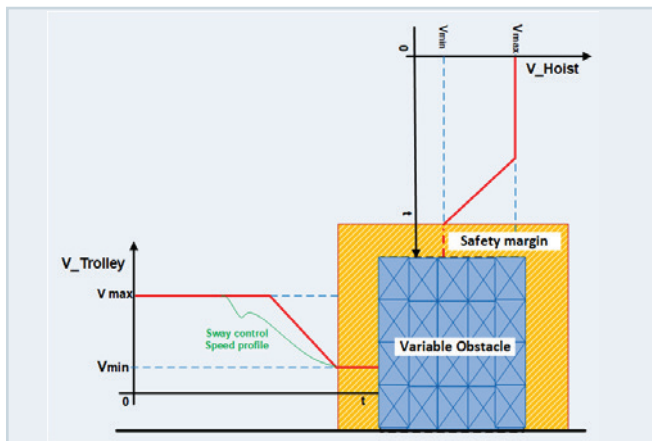


Fig 1 Soft-landing and smart-slow-down

Sway Controlled and damped in positioning

SIMOCRANE Sway Control System damps and controls the sway of the load using a complete and approved mathematic model. The system can adapt its behavior according to different required scenarios. For example, to tolerate some sway for quickly speed-up and to remove sway without overshooting at target position. A stable and repeatable movement ensure high productivity and safety.

Skew damping and Trim-List-Skew positioning

During the crane movement, the container has often uncontrolled skew oscillation and unexpected trim/list/skew angle because of wind or unsymmetrical distributed load in container. This phenomenon becomes visible especially before landing into the ship cells or over the lash platform. This undesirable skew oscillation is uncontrollable for operators. As solution, Siemens provides you the skew-damping function which can be executed either by a hydraulic system or by an electric system. In addition, the TLS-positioning can help you to move the spreader automatically to the same TLS-position as last time in waterside or landside.

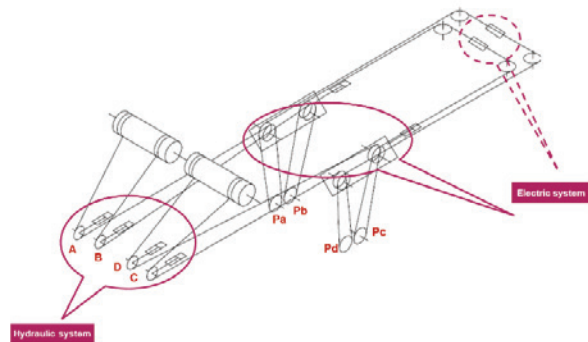


Fig 2 Hydraulic system combined with electric system

'Blocked region' increases safety and flexibility

A blocked region is defined by an area with physical or virtual obstacle plus a predefined safety margin. No movement is allowed inside this region except of 'Soft Approach' in Manual Mode. It is important to consider all obstacles in calculation of the 2D-trajectory. Siemens Sway Control System provides four different ways to build up and update the blocked regions:

- By defining fixed obstacles during commissioning.
- By learning and moving if no additional bay scanner exists.
- By connecting with point laser as bay scanner.
- By receiving a complete 2D ship profile from higher level controller.

A safety margin is defined to cover sensors uncertainty and inaccuracy. In addition, various monitoring and reactions required are implemented to make crane movement safe and efficient.

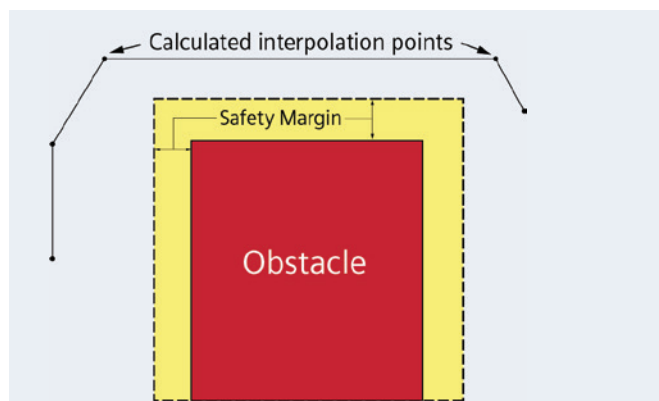


Fig 3 Definition of a blocked region

Selectable concepts for 2D-Trajectory

The 2D-trajectory calculation is usually carried out at the start of Semi-Automatic Mode (SAM), but it can also be triggered by a higher level controller if the ship profile is updated after SAM starts. Additionally, the trajectory will be recalculated to dynamically adapt changes in maximum speed, target position and ship profile on the fly for safety reasons.

To reach high productivity, the 2D-trajectory is based on time-optimized criteria. However, if a crane operator sits in the cabinet, the 2D-trajectory considers his unwell feeling during

backwards movement from waterside to landside. In this case, the system provides a trajectory with later lowering point compared to cases which the operator is in a remote control room.

The figure below shows the spreader lowers later in the former case than the latter one. Here the safer feeling of crane driver is more important than time saving.

Besides, the half parabolic trajectory can be properly adapted to meet customer special requirements, like optical feeling.

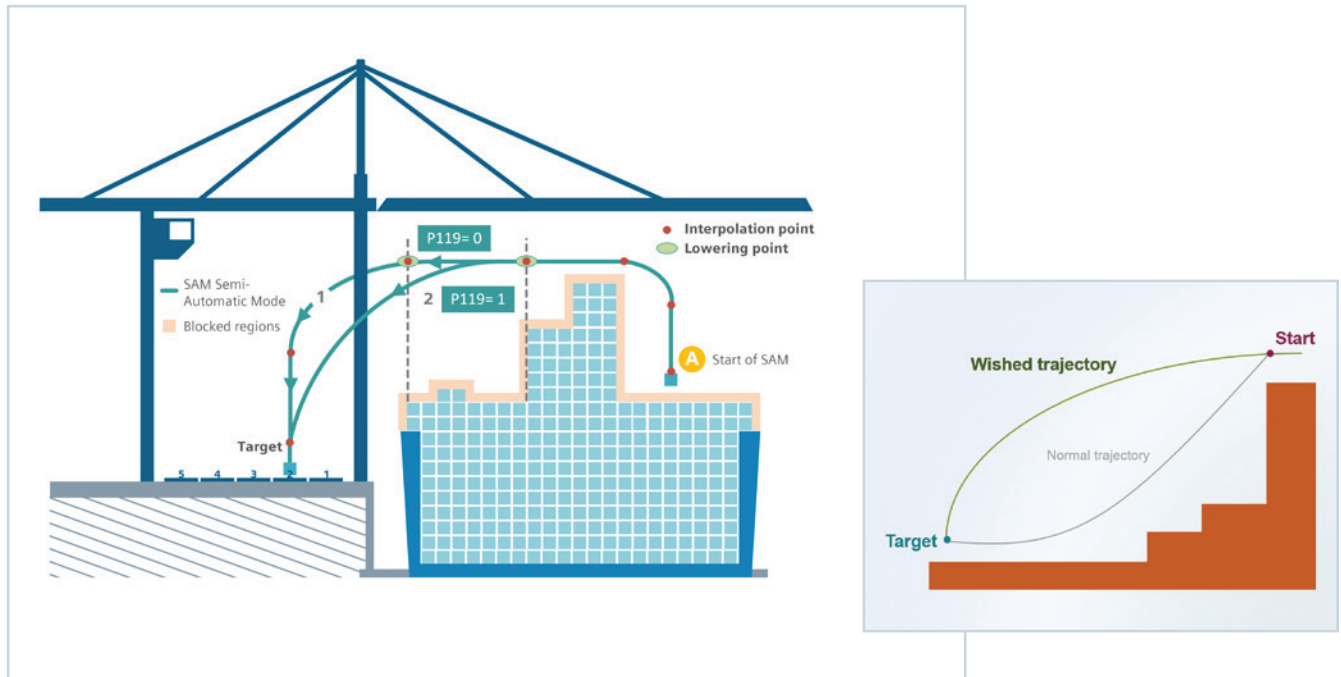
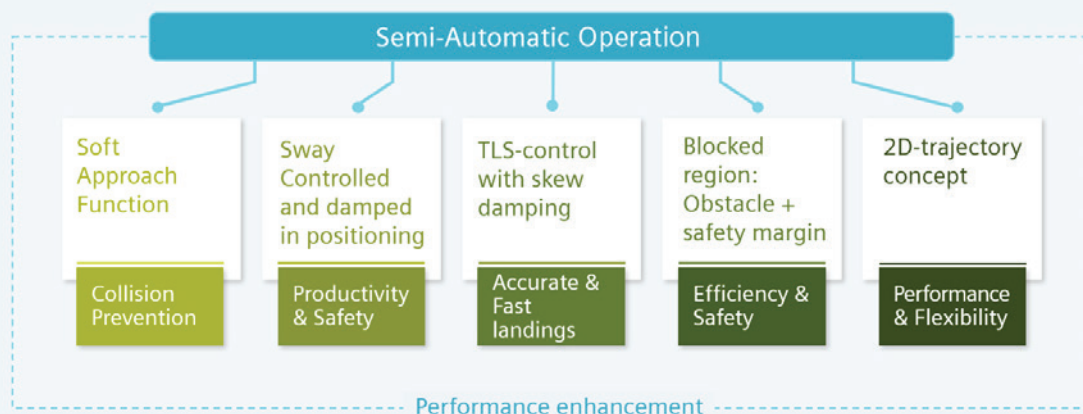


Fig 4 Different concepts for cabine control and remote control. Besides there is possibility to adapt the half parabolic trajectory.



Altogether builds up the Semi-Automatic Operation

The Semi-Automatic Mode (SAM) from Siemens Sway Control System combines most of the described functions to move coordinately hoist and trolley of a STS crane from its started position to a defined target, along a required optimized trajectory. Together with Soft Approach function and TLS-control, SAM makes the semi-automatic operation efficient and safe.

A typical semi-automatic operation from waterside to landside: A crane driver starts hoist with Manual Mode (MAN) until over the safety height, then switches over to SAM on the fly. After the container lowers to the safety height over target in landside, the crane driver or a higher-level controller takes over for final landing, if required. Otherwise, the SAM can set the container directly to the final position. It is possible to activate Dual cycling operation with direct connection to Terminal Operation System (TOS).

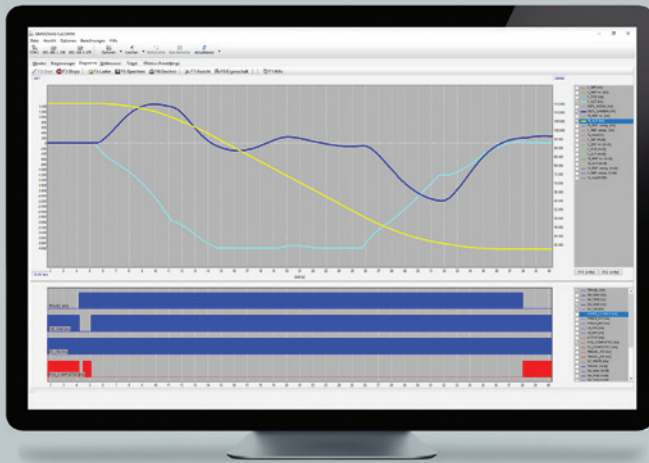


Fig 5 A stable, repeatable and safe movement profile in SAM

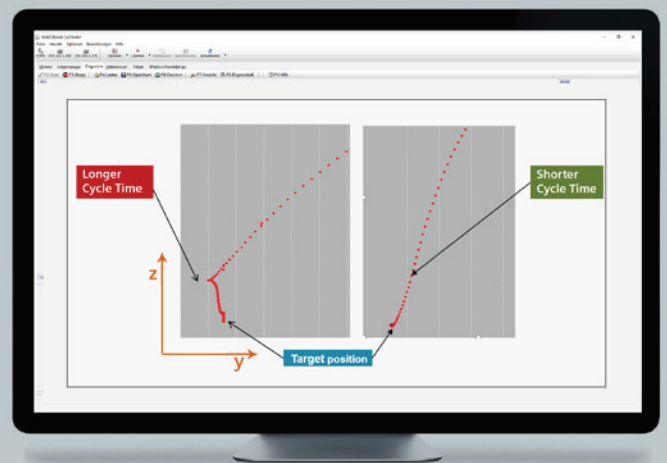


Fig 6 Comparison of trajectory with and without overshooting

CeCOMM - A powerful tool for commissioning and diagnostic

The SIMOCRANE CeCOMM program is designed for following commissioning and diagnostic tasks:

- Editing of parameter sets
- Monitoring important data
- Trace function for recording signals, interpolation points and obstacles
- Optimizing performance and troubleshooting
- Graphic visualization of many parameters

Enhancing performance in a safer manner

Safety is an important precondition for SAM movement. At the same time, high productivity goals are achieved. Siemens Sway Control System minimizes overshooting at the end of positioning, hence shortens cycle time, especially while approaching a low target with rapid lowering speed.

A skillful crane operator applies different sway control strategies at acceleration and deceleration, which can reduce cycle time, too. However, human success can happen at random, unrepeatably and in unsafe ways. This skillful behavior is now rebuilt in the SAM workflow with repeatable and stable performance enhancement, in safer manner.

Integrated Solution

SIMOCRANE SC integrated STS, GSU order-number: 6GA72000AA011AA0 (Advanced Control)

Standalone solution

SIMOCRANE CeSAR standalone STS, GSU order-number: 6GA72001AA011AA0 (Advanced Control)

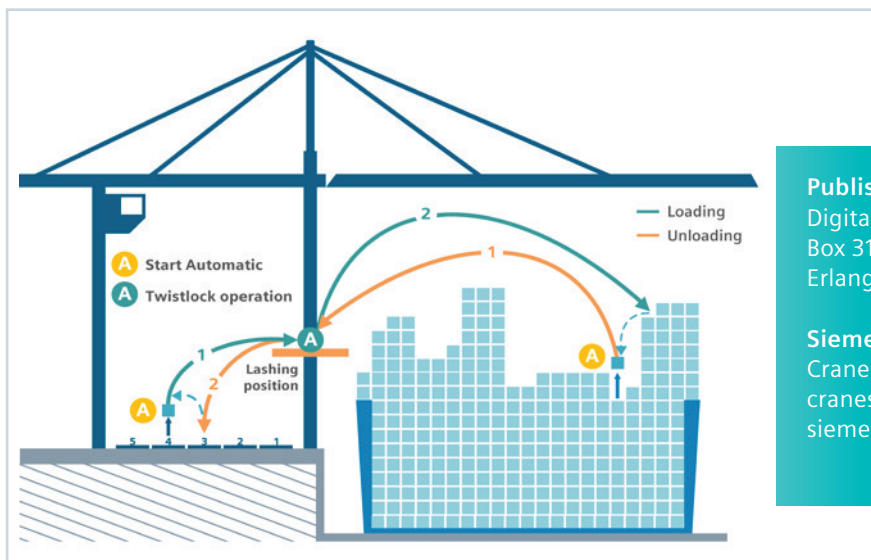


Fig 7 Dual Cycling Operation

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