SIMOTION Flying Saw V2.1
The application SIMOTION Flying Saw was developed with the objective to address many of the known cutting applications using just one application software.

When required, the application can be configured or also changed as a result of openness.

Using the SIMOTION control platform the application SIMOTION Flying Saw allows to realize flying saw or flying shears to be implemented for the widest range of applications, e.g. foil, film, paper, corrugated etc.

Works in combination with:
SIMOTION Line Axis / SIMOTION Axis Function Block
Converting Toolbox
Benefits when using the Application

- Shorter engineering and service times (same look & feel)
- Can be used in all programming languages
- Industry standards are used
- Supported by the various PM Application Centers
- Continuously updated in the Intranet
- Essentially open source code so that you can adapt the functions to your requirements
- User Manuals in English and German
- Simple to learn & get to know using application examples
- Free of Charge
Converting Toolbox
Contents of the Application

- PowerPoint presentation (English / German)
- Units / libraries (programming in either ST or MCC)
- User Manuals (English / German)
- Example project for SIMOTION D demonstration case
- Feedback sheets (English / German)
- Change log (change history)
A material web, fed using the material feed mechanism is to be cut into identical parts and sections. As a result of the characteristics of the material, the material cannot be cut at once across the whole width of the web with just one cut. In order that the motion of the material web does not have an impact on the cut, either the material web must be stopped during the cut, or the cutting device must be moved in synchronism with the material web – i.e. the material web is cut "on the fly".

**Why flying processing/machining?**
"Flying" processing/machining is required, if
- the flow of products were to be stopped due to a sub-process (generally a thermal process) this would result in a reduction in quality or even waste.
- stopping the product flow cannot be justified as a result of the energy demand when decelerating and accelerating.
- the individual processing/machining steps are too different so that a standard delay time cannot be justified from a cost-effective perspective.
Converting Toolbox
Scope of Functionality

- With the application Flying Saw the common work procedures can be done „on the fly“. With continuously processing a faster and energy optimized operation is possible.
- The traversing slide with the cutting tool will be synchronized to a predefined position on the product periodically. During cutting process transfer speed and tool speed are the same.
Converting Toolbox
Scope of Functionality

Speed diagram:

1.) Start position / start synchronizing
2.) Start operation phase
3.) Start desynchronizing
4.) Traverse back to start position
Converting Toolbox
Scope of Functionality

- Open source
- Precisely synchronizing at a specific position
  - In the processing domain the tool and the web have the same velocity
- Set starting position of the „flying“ axis
  - Starting position can be changed on the fly between two cuts
- „Cutting“ at a print mark
  - The synchronous position is detected using a measuring probe and a print mark
- „Cutting“ to length
  - The synchronous position is calculated from the distance the material has moved
- Immediate Cut
  - A cut can be initiated by the operator
- Creating a gap
  - The cutting unit additionally moves the web after the cut
Converting Toolbox
Additional Functions in Version 2.1

The application now has two different ways of determination of cut position:
- **CP_CALCULATED** (new): Synchronising to a fix material position. The material axis position is reduced by length after each cut. The material axis has to be a linear axis!
- **CP_MEASURED** (old): In this way, the cut position will be detected at a real measuring sensor [CPM_DETECTED] or simulated by calculation at a virtual sensor [CPM_SIMULATED] and entered into a cut position buffer. This buffer is read out for synchronization of the flying saw. The material axis has to be a modulo linear axis!

Interrupt-/Continue Production
- With the button "interrupt production" the flying saw axis will be "disabled" after reaching stand still. The standard application keeps in mode "AUTOMATIC".
- In this state the flying saw axis can be switched into safe mode (emergency stop, STO, ....). The actual position of axis can be changed manual.
- If safe mode of flying saw axis is switched of the axis can be "enabled", put back to start position and the production can be started again with the button "continue production".

Three different ways to synchronize flying saw axis:
- **BY_TIME:** The synchronizing will be specified by default parameter speed, acceleration and jerk of flying saw axis.
- **BY_LEADING_VALUE:** The synchronizing will be specified by the variable sUsersInterface.r64SyncLength.
- **SYMMETRIC:** The synchronizing will be done by asymptotic adjustment of flying saw axis material velocity without any overshoot.
The Flying Saw functionality is part of the Library LFSLib and included in the application SIMOTION Flying Saw:

The Library consists of 2 Units:
- FS_Progs
- FS_Template:
## Converting Toolbox
### Function Block Overview - FBFlyingSaw

<table>
<thead>
<tr>
<th>Function Block</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBFlyingSaw</td>
<td></td>
</tr>
<tr>
<td>LREAL</td>
<td>cutLength</td>
</tr>
<tr>
<td>BOOL</td>
<td>execute</td>
</tr>
<tr>
<td>eOperationMode</td>
<td>mode</td>
</tr>
<tr>
<td>FlyingSawType</td>
<td>stopCutting</td>
</tr>
<tr>
<td>BOOL</td>
<td>knifeOut</td>
</tr>
<tr>
<td>LREAL</td>
<td>gapLength</td>
</tr>
<tr>
<td>BOOL</td>
<td>gap</td>
</tr>
<tr>
<td>BOOL</td>
<td>onTheSpotCut</td>
</tr>
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<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **cutLength**: LREAL
- **execute**: BOOL
- **mode**: eOperationMode
- **stopCutting**: BOOL
- **knifeOut**: BOOL
- **gapLength**: LREAL
- **gap**: BOOL
- **onTheSpotCut**: BOOL
- **done**: BOOL
- **busy**: BOOL
- **error**: BOOL
- **flyingSawInStartPos**: BOOL
- **endSyncPosReached**: BOOL
- **onTheSpotCutPossible**: BOOL
- **onTheSpotCutDone**: BOOL
- **syncNotPossible**: BOOL
- **forSyncToLate**: BOOL
- **errorId**: DWORD
- **status**: eOperationModes
- **rotaryKnifeAxisActive**: BOOL
- **sTOsType**: sTOsType
- **sUserInterface**: sUserInterfaceType
- **sFlyingSawInfo**: sFlyingSawInfoType
- **sCutPositionBufferManagement**: sCutPositionBufferManagementType
- **sMeasuringValue**: sMeasuringValueType

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- Introduction
- Benefits when using the Application
- Scope of Functionality
- Additional Functions in Version 2.1
- Function Block Overview
- Example Configuration
- Example Project
- TestFB-Project
Example Configuration:
(Medium to high Performance, Machine control or stand alone)

- SIMOTION D4x5
- SINAMICS S120 DC/AC
- SINAMICS SLM/BLM/ALM
- Breaking Resistor (optional)
- 1FK/1FT Motor

Standards:
- SIMOTION Flying Saw
- SIMOTION Line Axis or SIMOTION Axis Function Block

Benefits:
- High hardware integration (no special controller required)
- Standard Hardware – No „Black Box“ solution or special components
- Modular Solution with scalable performance
- Flexible infeed concepts
Example Configuration: (Low Cost / low Performance)

- SIMOTION D410
- SINAMICS S120 AC/AC
- Breaking Module (optional)
- 1FK7 Motor

Standards:
SIMOTION Flying Saw
SIMOTION Line Axis or SIMOTION Axis Function Block

Benefits:
- Cheap and simple stand alone solution (no special controller required)
- Onboard I/O inclusive fast inputs (print mark detection)
- Onboard TTL/HTL/SSI Encoder interface for Machine Encoder
- Standard Hardware – No „Black Box“ solution or special components
Converting Toolbox Example Project

<table>
<thead>
<tr>
<th>Setting</th>
<th>Manual</th>
<th>Auto</th>
<th>Technology</th>
<th>Status</th>
<th>Home</th>
</tr>
</thead>
</table>

**Standard Application SIMOTION**

- Flying Saw
- Flying Saw Mode
- Actual Velocity / Position
  - Flying Saw: 0 / 276
  - Material: 79 / 973
- Cutting Time
  - sel: 2000 ms
  - act: 0 ms
- Velocity
  - to Startposition: 100 mm/s
  - Back to Start: 150 mm/s
- Material Velocity
  - Flying Saw STARTPOS
  - Material: 79 mm/s
- Cutlength
  - measured: 650 mm
  - calculated: 700 mm
- Sync Position
  - Material: 100 mm

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Converting Toolbox TestFB-Project

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Thank you for your attention!

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