DOCUMENTATION ISG-kernel

Functional description
Taper link

Short description:
FCT-C49

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Documentation version: 1.00
20/10/2025

Preface

Legal information

This documentation was produced with utmost care. The products and scope of functions described are under continuous development. We reserve the right to revise and amend the documentation at any time and without prior notice.

No claims may be made for products which have already been delivered if such claims are based on the specifications, figures and descriptions contained in this documentation.

Personnel qualifications

This description is solely intended for skilled technicians who were trained in control, automation and drive systems and who are familiar with the applicable standards, the relevant documentation and the machining application.

It is absolutely vital to refer to this documentation, the instructions below and the explanations to carry out installation and commissioning work. Skilled technicians are under the obligation to use the documentation duly published for every installation and commissioning operation.

Skilled technicians must ensure that the application or use of the products described fulfil all safety requirements including all applicable laws, regulations, provisions and standards.

Further information

This link

https://www.isg-stuttgart.de/de/isg-kernel/kernel-downloads.html

contains further information on messages generated in the NC kernel, online help, PLC libraries, tools, etc. in addition to the current documentation.

Disclaimer

It is forbidden to make any changes to the software configuration which are not contained in the options described in this documentation.

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General and safety instructions

Icons used and their meanings

This documentation uses the following icons next to the safety instruction and the associated text. Please read the (safety) instructions carefully and comply with them at all times.

Icons in explanatory text

➢ Indicates an action.

⇨ Indicates an action statement.

⚠ DANGER

Acute danger to life!

If you fail to comply with the safety instruction next to this icon, there is immediate danger to human life and health.

⚠ CAUTION

Personal injury and damage to machines!

If you fail to comply with the safety instruction next to this icon, it may result in personal injury or damage to machines.

Attention

Restriction or error

This icon describes restrictions or warns of errors.

Notice

Tips and other notes

This icon indicates information to assist in general understanding or to provide additional information.

Example

General example

Example that clarifies the text.

Programing Example

NC programming example

Programming example (complete NC program or program sequence) of the described function or NC command.

Release Note

Specific version information

Optional or restricted function. The availability of this function depends on the configuration and the scope of the version.

Table of contents

List of figures

1 Overview

Task

In a 2-path application with active tool radius compensation, the "taper link" functionality is intended to ensure that the programmed wire angle is retained even if additional motion blocks are required.

Release Note

This functionality is available as of CNC Build V3.1.3108.

Notice

This function is an additional option requiring a license.

Properties

There must be a 2-path configuration. The functionality requires an active tool radius compensation in both paths.

Programming

The function is activated by the #TRC command with the TAPERLINK option [▶ 13]. The function is only effective if the option is selected and tool radius compensation (G41/G42) is active.

Mandatory note on references to other documents

For the sake of clarity, links to other documents and parameters are abbreviated, e.g. [PROG] for the Programming Manual or P-AXIS-00001 for an axis parameter.

For technical reasons, these links only function in the Online Help (HTML5, CHM) but not in pdf files since pdfs do not support cross-linking.

2 Description

The condition for using the taper link function is a 2-path configuration [▶ 11].

Tool radius compensation permits the programming of a workpiece contour irrespective of tool geometry. When tool radius compensation is selected (G41, G42), a tool path is calculated that is equidistant to this programmed tool contour at a distance of the "tool radius".

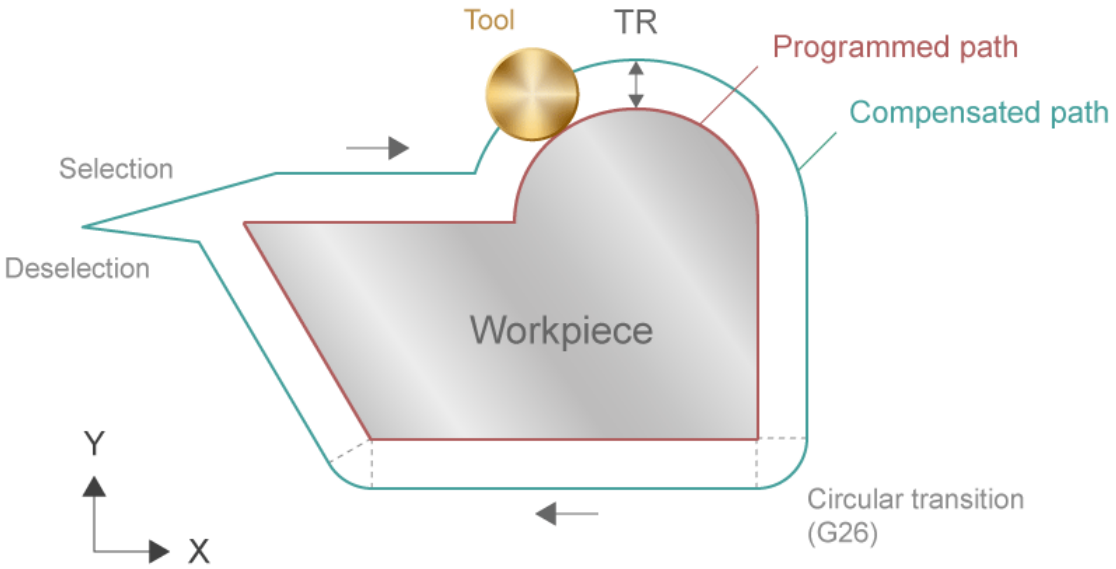

Fig. 1: Tool radius compensation - tool radius path

When an equidistant path is generated, tool radius compensation inserts contour elements in order to obtain a continuous contour (C1). Using tool radius compensation to insert contour elements is path-specific and is dependent on the geometric transitions of each contour. As a result, the two contours have a different number of geometric elements.

The taper link function then synchronises the reference (lower) and secondary (upper) paths in order to retain the originally programmed connection (wire angle) between the two paths.

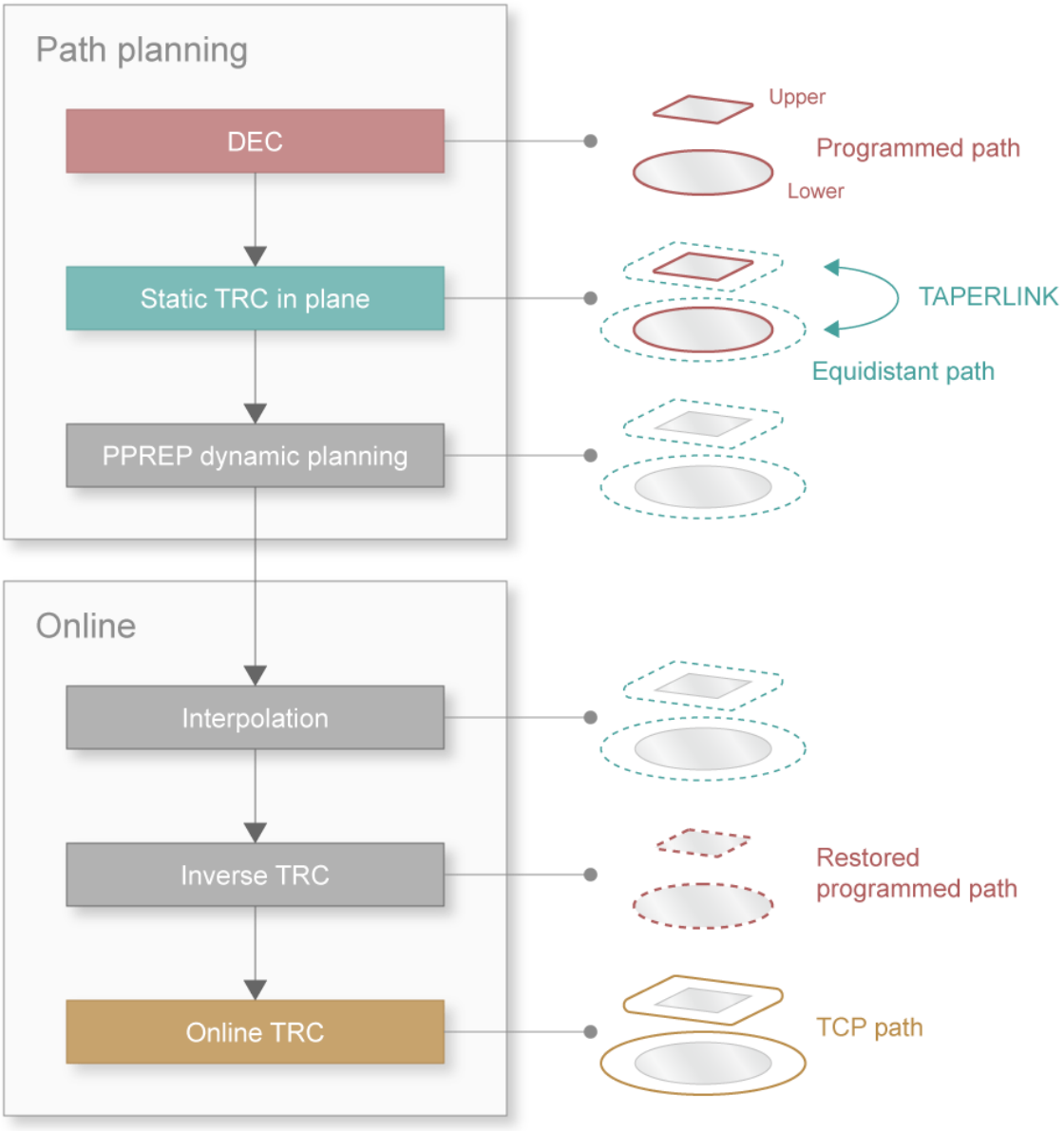

Fig. 2: Placing the function in the channel

Any geometry (linear, circular) in a contour can result in a compensation motion in the other (linear) path.

The functionality is activated by the NC command #TRC [TAPERLINK=1/2/3] when tool radius compensation (G41/G42) is active.

There is no predefined sequence of NC commands.

Schematic diagram of taper link function (inactive/active)

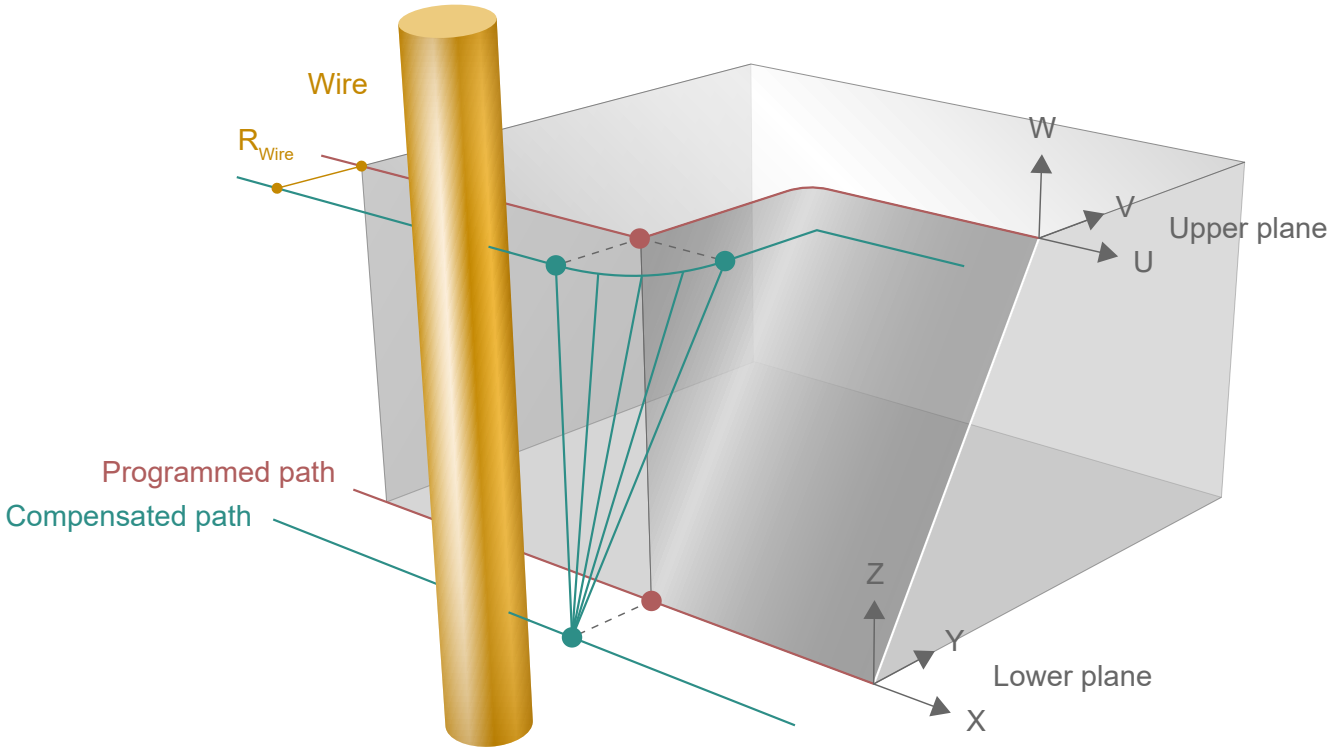

Fig. 3: Without taper link function at the outer corner

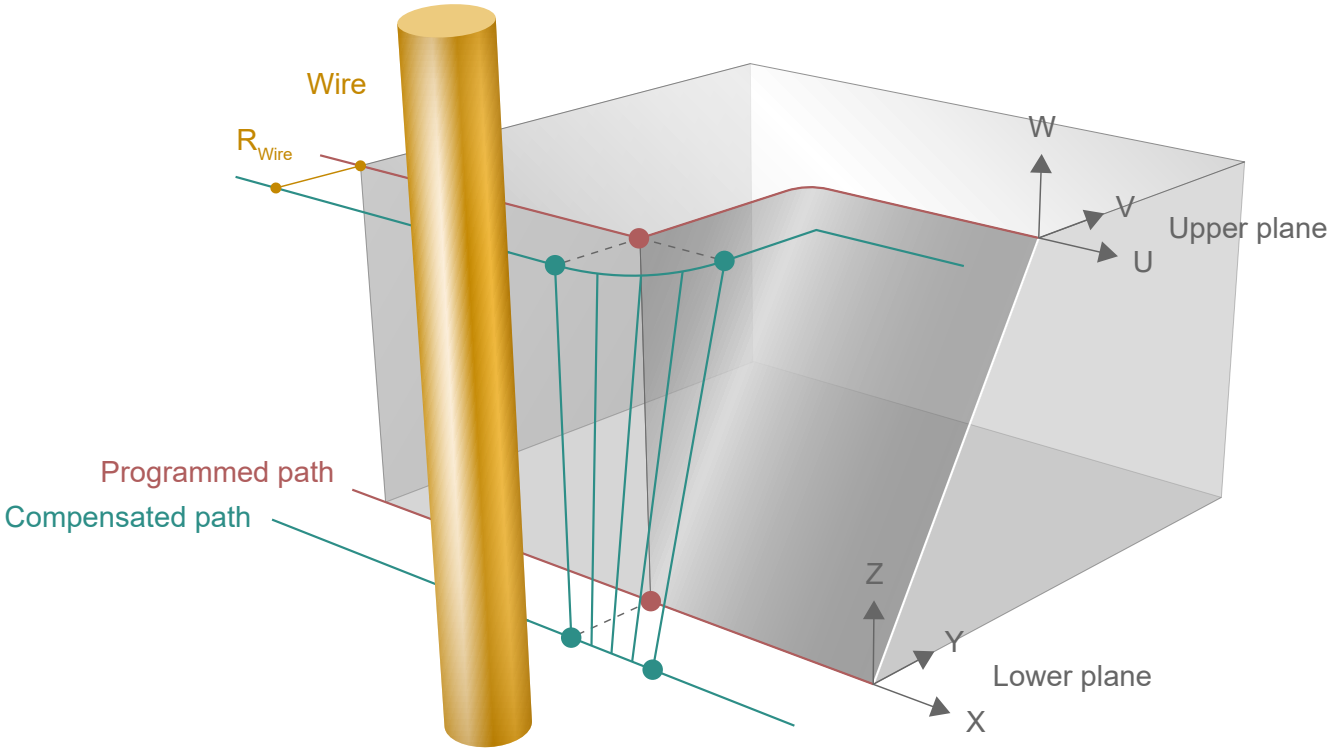

Fig. 4: Active taper link function at outer corner

The taper link functionality is shown by means of a simple geometry (inactive/active):

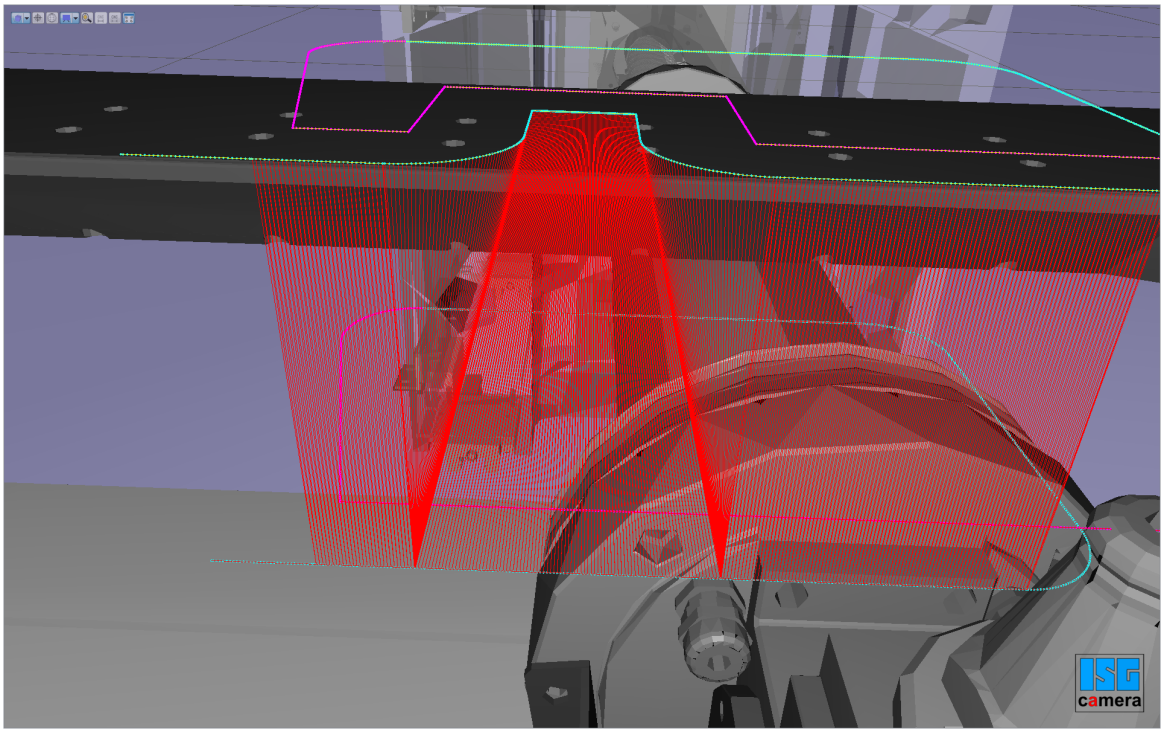

Fig. 5: Simple example without taper link functionality

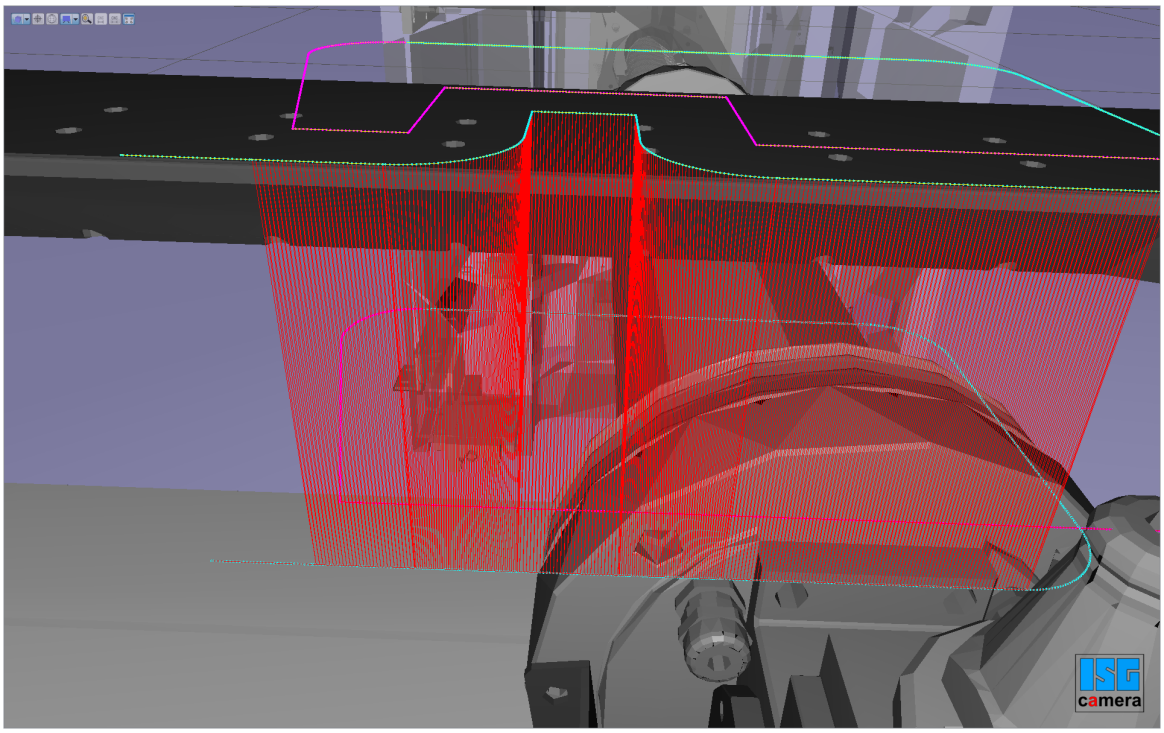

Fig. 6: Simple example with active taper link functionality

2.1 Configuration

The CNC is configured for 2-path programming in the channel parameter list.
The following settings are required:

- Set channel parameter P-CHAN-00261 [▶ 18] (multi_path_configuration) to 1.
- At least 6 axes (2x3 path axes) are configured with no gaps.
- Optional: Depending on the technology, an additional axis may be required as the 7th axis, e.g. with EDM wire erosion, to adapt the height of the upper wire guides for compensation motions. The 7th axis must be configured with no gaps directly after the 6 path axes.

Example

2-path configuration with 7 axes as extract from the channel parameter list:

```
multi_path_configuration 1

gruppe[0].bezeichnung IPO_1

gruppe[0].achs_anzahl 7

gruppe[0].achse[0].log_achs_nr 1
gruppe[0].achse[0].bezeichnung X

gruppe[0].achse[1].log_achs_nr 2
gruppe[0].achse[1].bezeichnung Y

gruppe[0].achse[2].log_achs_nr 3
gruppe[0].achse[2].bezeichnung Z

gruppe[0].achse[3].log_achs_nr 4
gruppe[0].achse[3].bezeichnung U

gruppe[0].achse[4].log_achs_nr 5
gruppe[0].achse[4].bezeichnung V

gruppe[0].achse[5].log_achs_nr 6
gruppe[0].achse[5].bezeichnung W

gruppe[0].achse[6].log_achs_nr 7
gruppe[0].achse[6].bezeichnung Z1
```

Axes X, Y, Z with index [0..2] are used for interpolation in the lower plane and axes U, V, W with index [3..5] are used for interpolation in the upper plane. Axis Z1 with index [7] defines the position of the upper wire guide in the Z direction. The Z height is required to calculate the motions of the wire guides.

2.2 Restrictions

A taper link function of any contour in the upper or lower path results in a compensation on the other linear contour.

- Taper link compensations are only possible for linear elements.
- The range for compensations only extends to the previous or following block, starting from the currently considered block transition.
- The secondary and reference planes may not be rotated. Only linear offsets using Cartesian transformations are permitted.
- The functionality may only be used in the G17 plane.

3 Programming

The TAPERLINK option permits synchronisation between the reference path and the s3econdary path in a 2-path configuration in order to obtain the optimum wire angle. See [FCT-C49, section: Description [▸ 7]].

The condition for using this function is a 2-path configuration [▸ 11] and selection of tool radius compensation using G41 or G42.

Syntax:

#TRC [[**TAPERLINK=**..] **]**

TAPERLINK =.. Define mode for the taper link function.

0: Taper link function inactive (default).

1: Taper link active: Compensation is active on both paths; automatic detection.

2: Taper link active: Reference path compensates the secondary path.

3: Taper link active: Secondary path compensates the reference path.

4 Applications

Case 1: Stepped linear elements

The two figures below show stepped linear motions with active and inactive taper link functionality (see lower section of the red lines).

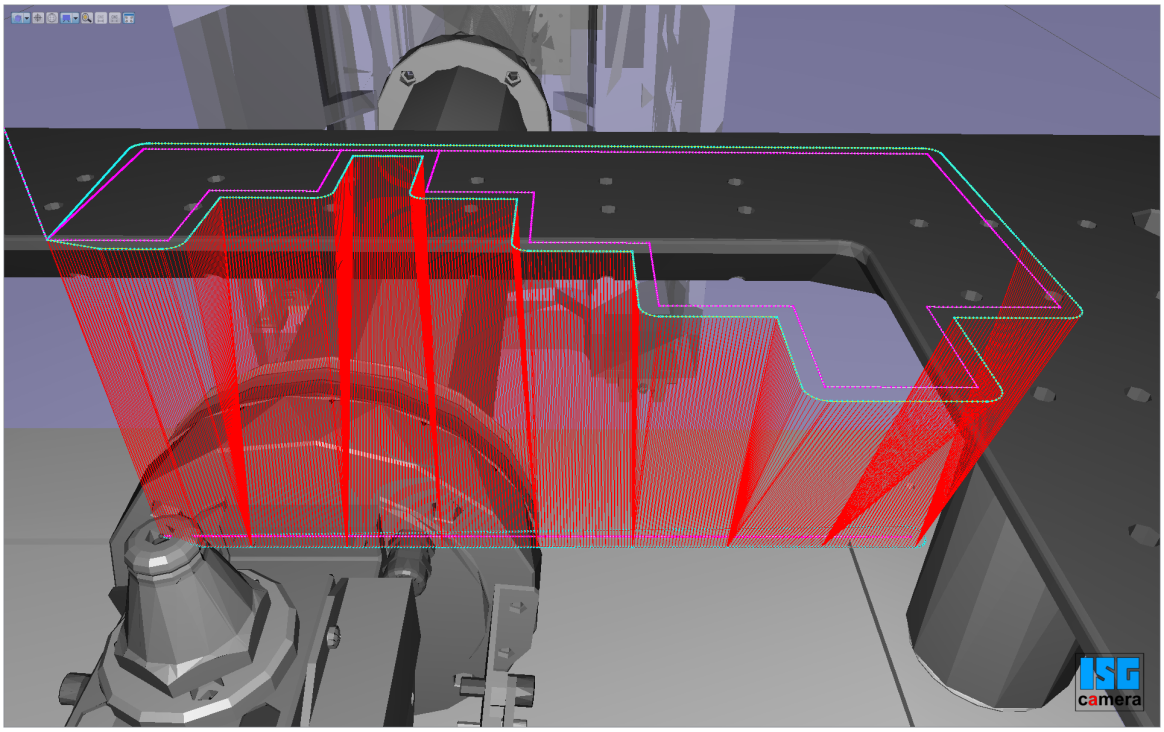

Fig. 7: Stepped linear motions without taper link functionality

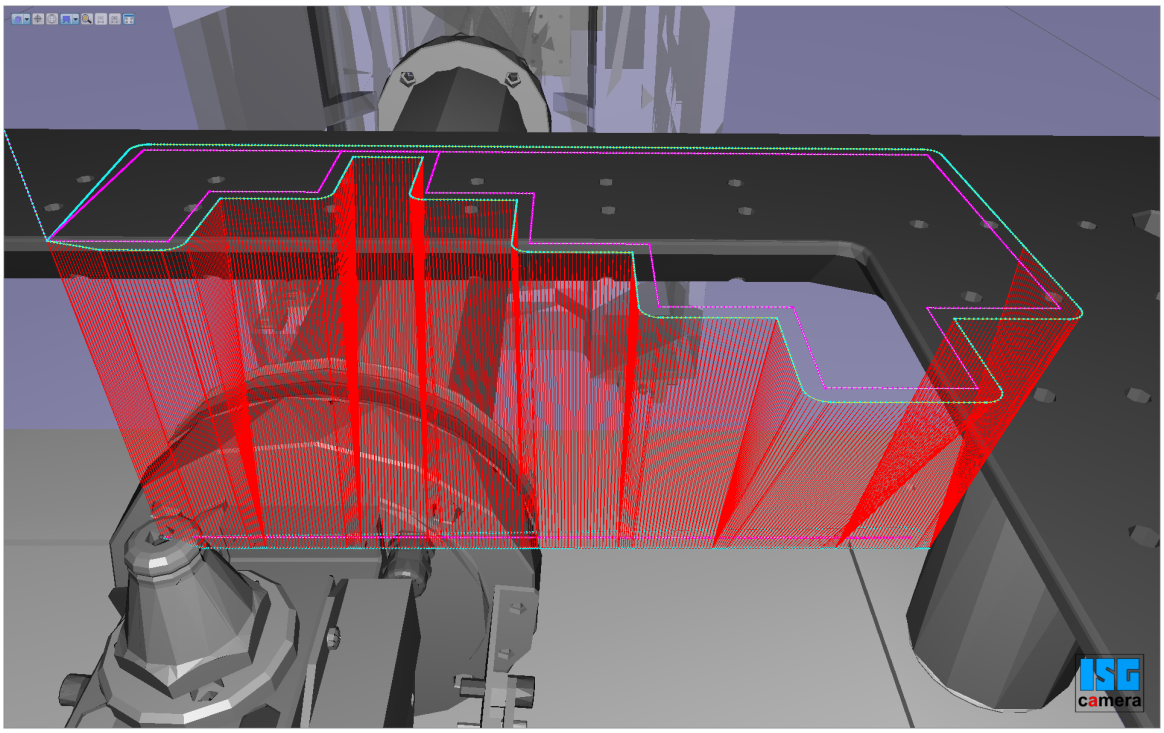

Fig. 8: Stepped linear motions with active taper link functionality

Case 2: Stepped circular elements

The two figures below show stepped circular motions with active and inactive taper link functionality (see lower section of the red lines).

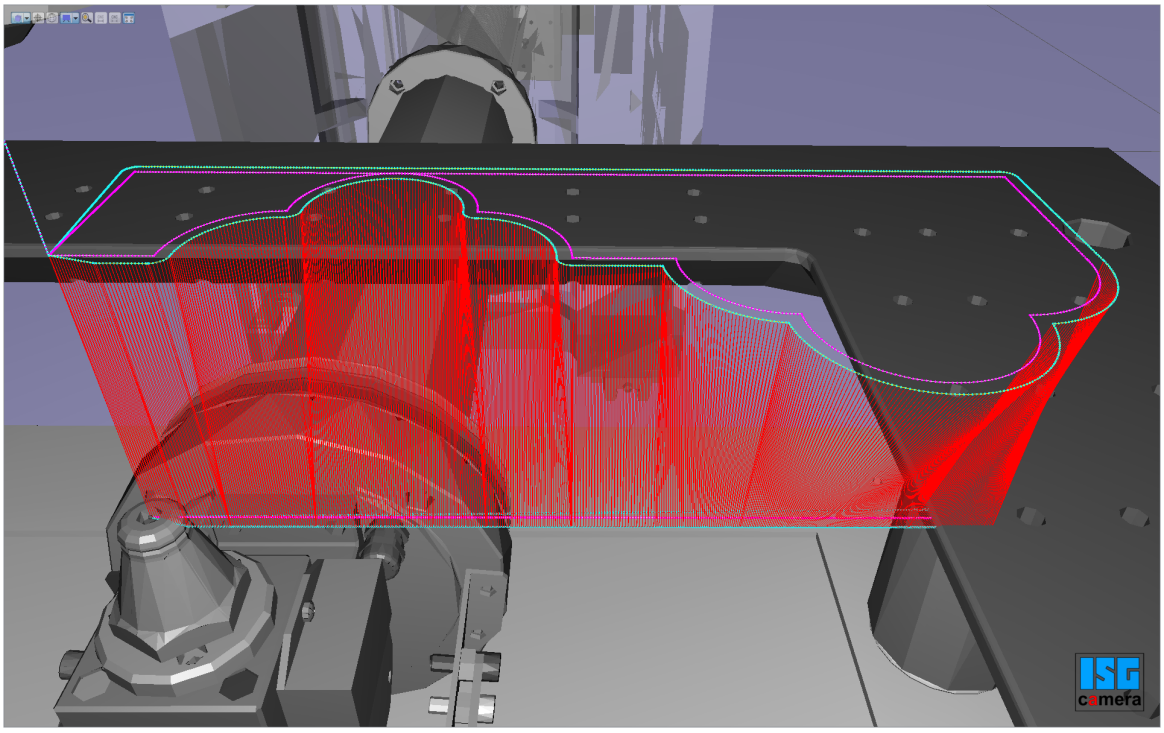

Fig. 9: Stepped circular motions without taper link functionality

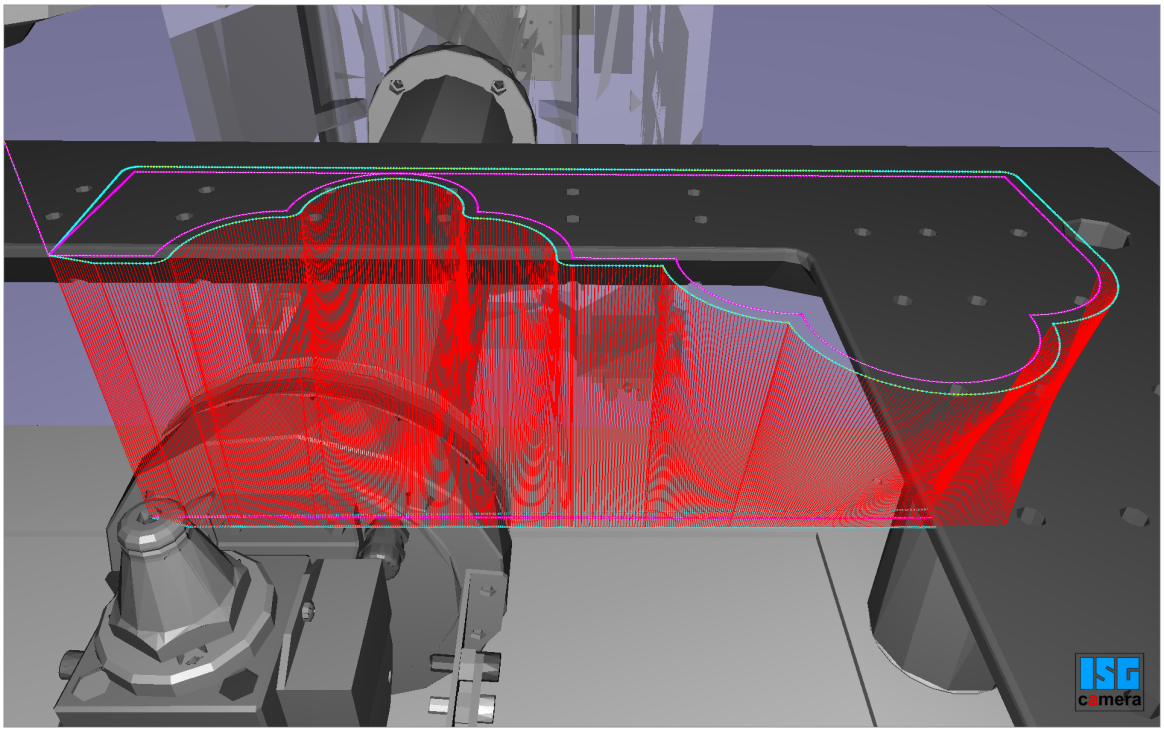

Fig. 10: Stepped circular motions with active taper link functionality

Case 3: Cone with circular element

The two figures below show a cone-shaped element based on a circular element with active and inactive taper link functionality (see lower section of the red lines).

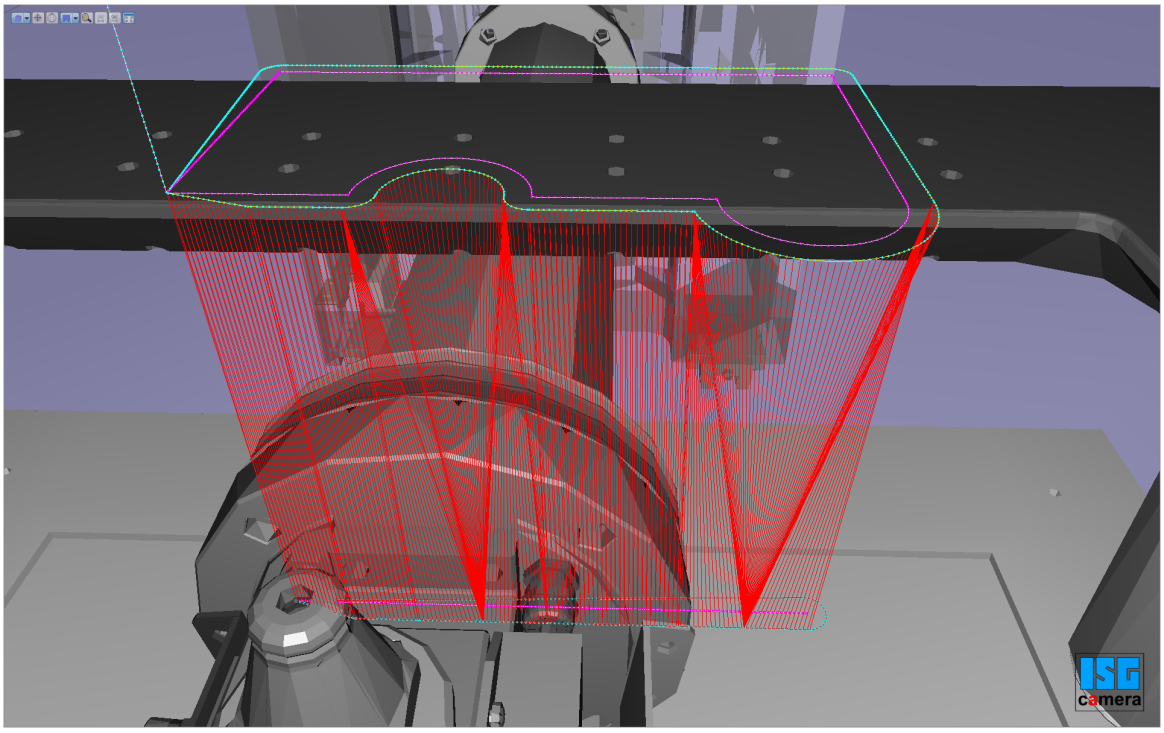

Fig. 11: Cone-shaped element without taper link functionality

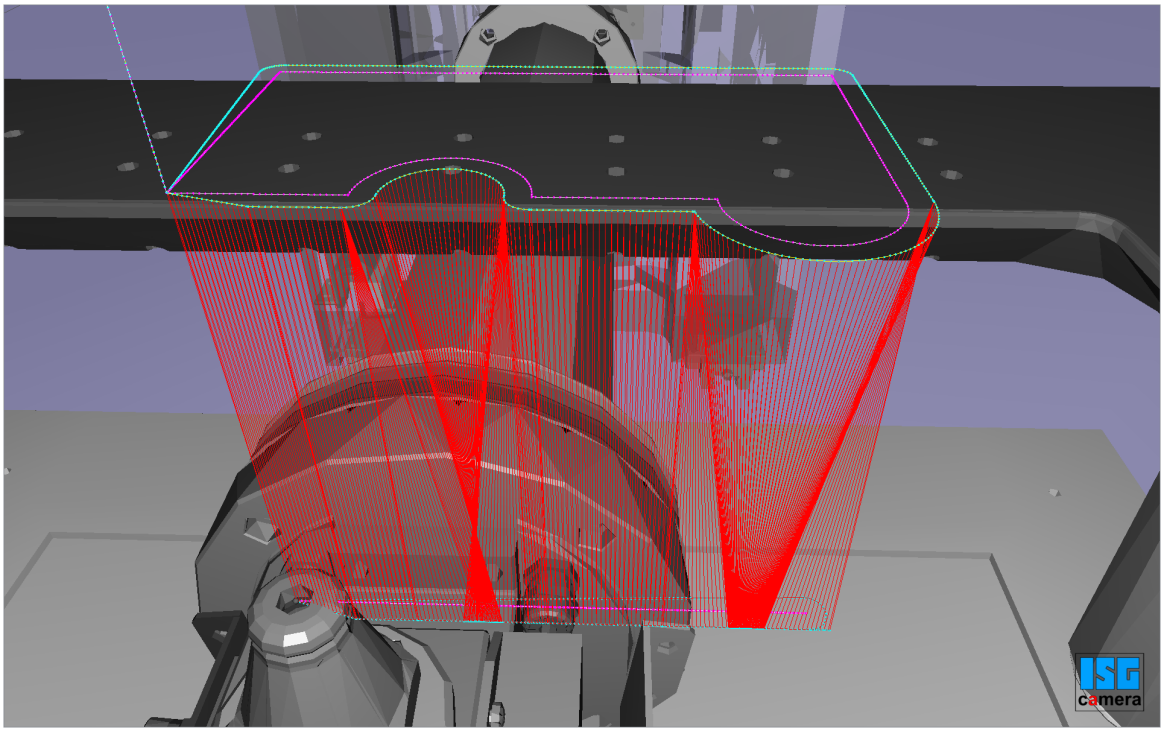

Fig. 12: Cone-shaped element with active taper link functionality

Case 4: Pyramid-shaped element

The two figures below show a pyramid-shaped element with active and inactive taper link functionality (see lower section of the red lines).

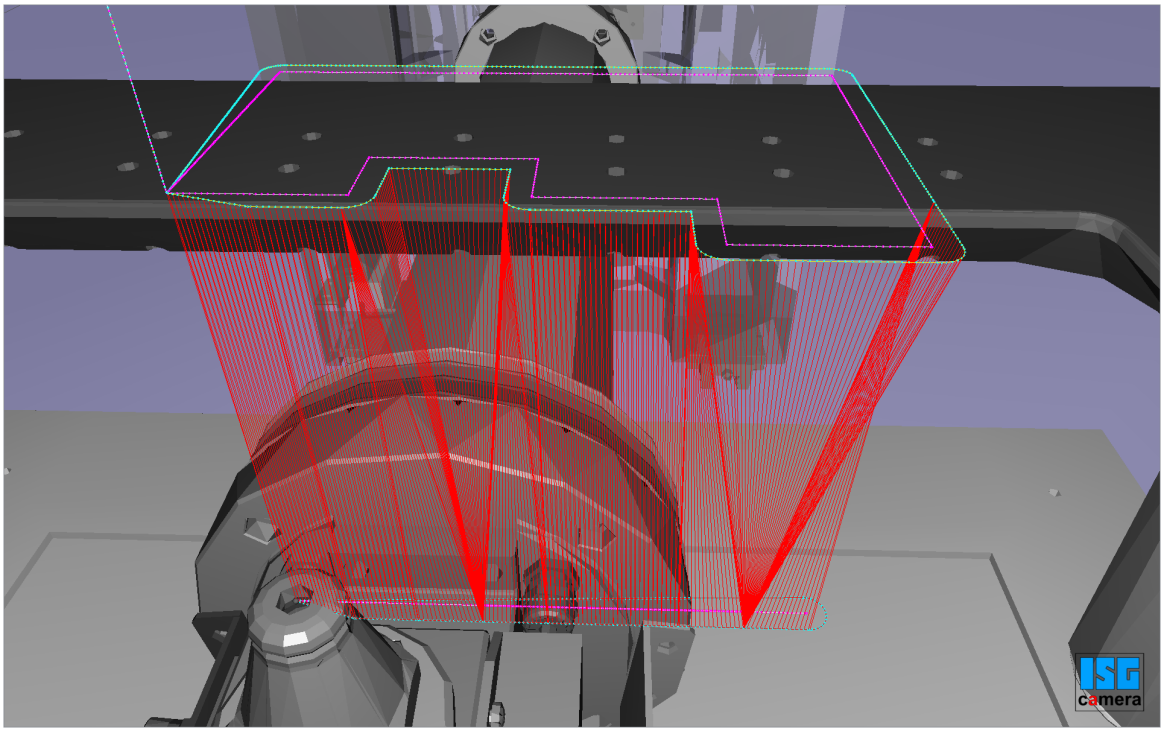

Fig. 13: Pyramid-shaped element without taper link functionality

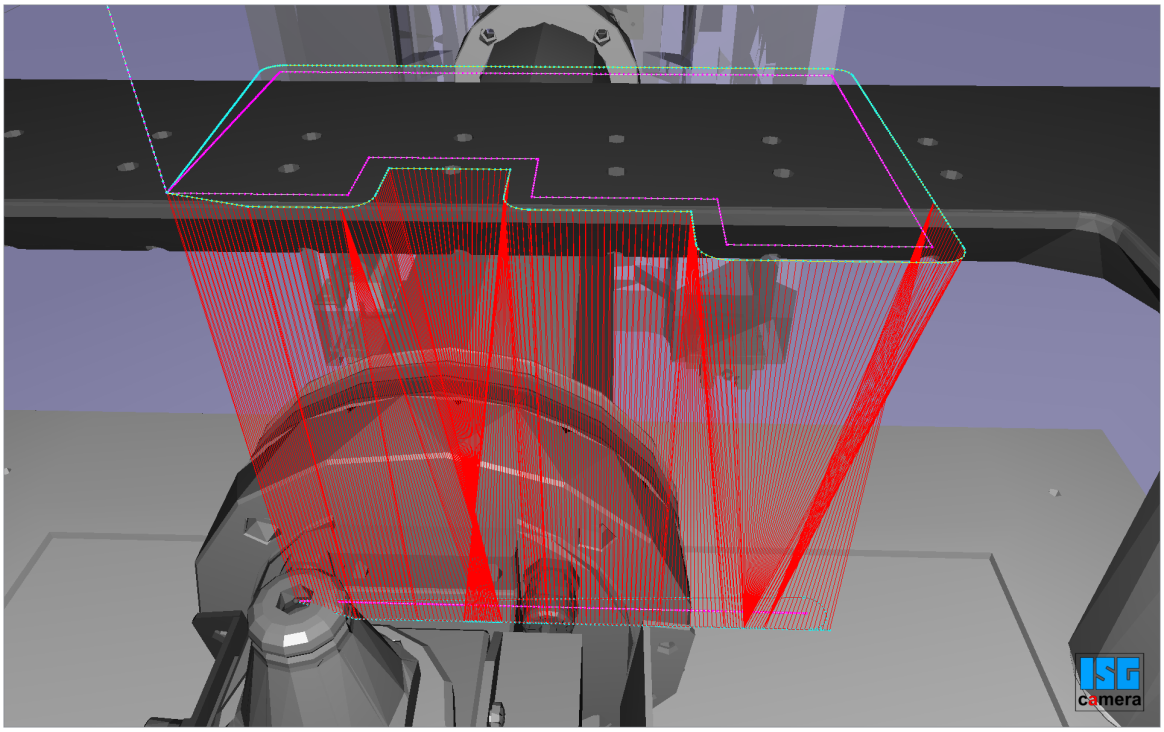

Fig. 14: Pyramid-shaped element with active taper link functionality

5 Parameter

The following parameters are required in the channel in order to use a 2-path configuration and 2-path programming:

P-CHAN-00261	**Enable 2-path programming**
Description	This parameter enables the NC syntax for 2-path programming. It permits the programming of two synchronous motions (paths) for 2 axis groups in the same NC block. The motions are separated in the NC block by a colon ':'. **<global> <separator> <path1> <separator> <path2>** Nxx G01 G90 F100 : X100 Y100 Z0 : U100 V100 W0
Parameter	multi_path_configuration
Data type	BOOLEAN
Data range	0/1
Dimension	----
Default value	0
Remarks	When 2-path programming is active, the colon ':' signifies a separator in the syntax. Jump marks to block numbers Nxx: (also called expression labels) is not possible, but only jumps on string labels are allowed.

P-CHAN-00550	**Definition of functionalities for tool radius compensation**
Description	This parameter defines individual functionalities for tool radius compensation.
Parameter	configuration.tool_radius_comp.function
Data type	STRING
Data range	MULTI_PATH: 2-path configuration and 2-path programming active -: No functionalities defined.
Dimension	----
Default value	*
Remarks	Parameter is available as of the following Builds: V2.11.2040.04 ; V2.11.2810.02 ; V3.1.3079.17 ; V3.1.3107.10 * Note: The default value of variables is a blank string. The parameters P-CHAN-00555 and P-CHAN-00556 can be used to define functions depending on the machining mode.

6 Appendix

6.1 Suggestions, corrections and the latest documentation

Did you find any errors? Do you have any suggestions or constructive criticism? Then please contact us at documentation@isg-stuttgart.de.

The latest documentation is posted in our Online Help (DE/EN):

QR code link: https://www.isg-stuttgart.de/documentation-kernel/

The link above forwards you to:

https://www.isg-stuttgart.de/fileadmin/kernel/kernel-html/index.html

Notice

Change options for favourite links in your browser;

Technical changes to the website layout concerning folder paths or a change in the HTML framework and therefore the link structure cannot be excluded.

We recommend you to save the above "QR code link" as your primary favourite link.

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