

旋刮(滚插)加工事例

外齿轮的加工精度

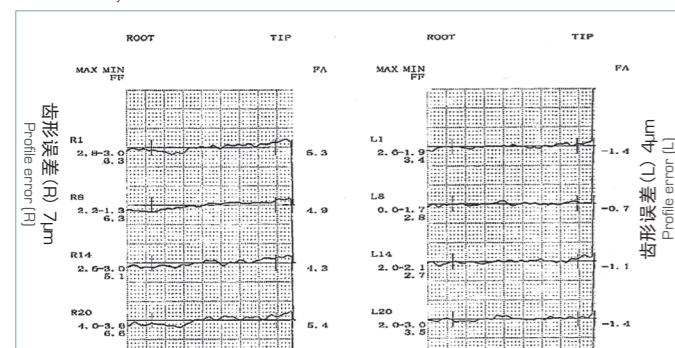
Processing Example by SKIVING CUTTER (Processing accuracy of External Gear)

外齿轮相对于内齿轮，加工理论上切削性能比较差，增大交叉角（30°以上）可提高切削性能和加工精度

"The machining of the external gear is theoretically inferior in machinability to the internal gear, therefore increasing the crossed axes angle improves the cutting performance and improves the machining accuracy"

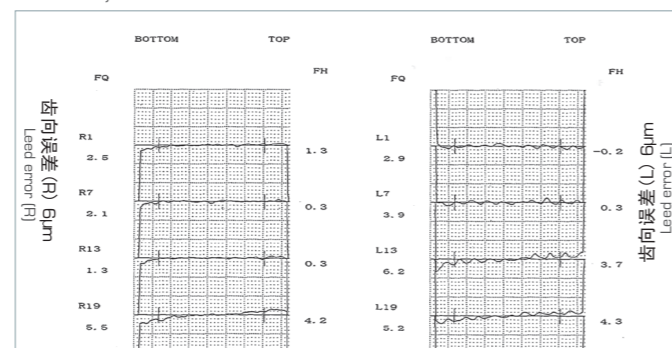
齿形精度

Profile accuracy



齿向精度

Lead accuracy



工件参数 (外齿轮)

Work specifications (External Gear)

模数	Module	2.7
压力角	Pressure angle	20°
螺旋角	Helix angle	20°(RH)
齿数	No. of teeth	27
齿宽	Tooth width	22mm
材质	Work material	SCM420

加工条件

Cutting conditions

	4次切削 4 Pass cutting			
	1Pass	2Pass	3Pass	精加工 Finishing
刀具转速 Cutter rotation	1600m ⁻¹			
滑动速度 Sliding speed	100m/min			
进给量 Feed amount	0.3mm/rev			0.2mm/rev
切入量 Depth of cut	2.2mm	1.8mm	1.5mm	0.3mm
冷却方式 Coolant	冷却液 (水溶性) Wet cutting (Water Soluble)			
加工数 No. of machined work pieces	100个 100 pieces			

刀具规格

Cutter specifications

交叉角	Crossed axes angle	30°
螺旋角	Helix angle	10°(LH)
齿数	No. of teeth	34
涂层	Coating	Hyper DuAl GP 前刀面有涂层 With coating on cutting face
材质	Cutter material	FAXG1

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适用小规模生产线齿轮加工

旋刮刀(滚插刀)

Suitable for gear machining on small scale line

SKIVING CUTTER



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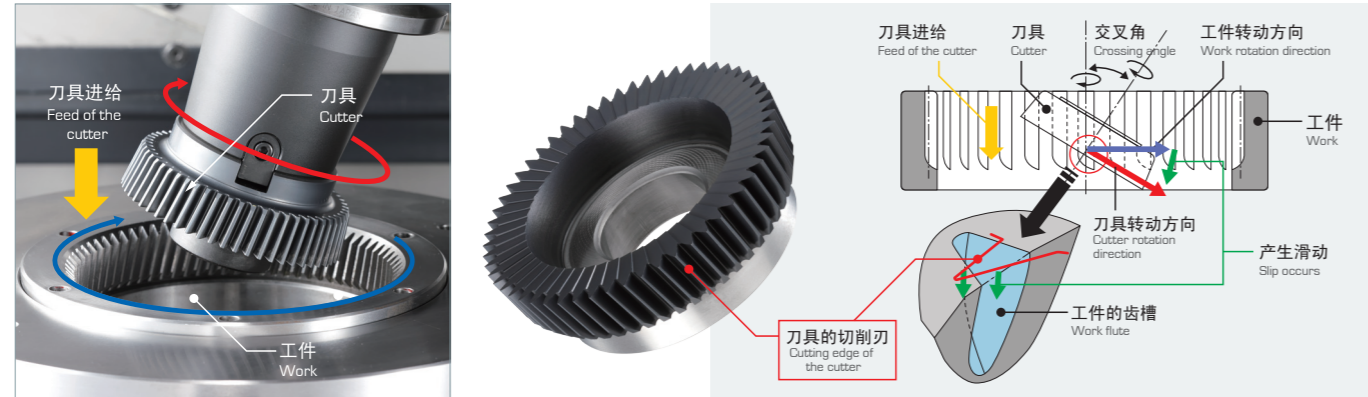
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旋刮(滚插)加工的机械原理

Mechanism of SKIVING process

在工件与刀具之间创造交叉角让其产生滑动，从而进行创成加工的加工方法

Apply crossed axes angle to workpiece and cutter, gear generating machining by sliding



旋刮(滚插)加工的特征

Characteristics of SKIVING process

齿轮加工法的特征比较

Comparison of characteristics of gear processing method

		滚刀加工 Hobbing	拉刀加工 Broaching	插齿加工 Gear Shaper machining	旋刮(滚插)加工 Skiving
加工品质 Cutting	生产性 Productivity	◎	◎	△	○
	加工精度 Processing accuracy	○	◎	○	◎
	换刀效率 Strip up	○	△	○	○
设备 Machinery	热处理后加工 Alter the heat treatment processing	○	×	×	○
	初期投资 Initial investment	○	△	○	○
工具费用 Tool cost	复合加工适应性 Combined processing suitability	△	×	×	◎
	初始 Initial cost	○	△	○	○
对象工件 Work	运行 Running cost	◎	◎	○	○
	外齿轮 External gear	◎	×	◎	○
	内齿轮 Internal gear	×	◎	◎	◎
	盲孔形状(阶梯) Blind shape (with stepped)	×	×	◎	○
齿形·齿线修正 Correcting profile and lead		△	×	×	◎

适用于少量多种类生产

- 加工能力是插齿加工的2倍以上
- 可加工盲孔形状
- 可修正齿形齿线
- 内齿轮、外齿轮均可加工
- 可使用复合加工机加工

- Suitable for a wide-variety small-lot production
- The processing efficiency for shaper machining
- To enable processing work of blind hole shape
- To enable correcting profile and lead
- Both internal gear and external gear can be machined
- Suitable to machining by combined processing machine

◎: 优异 ○: 一般 △: 差 ×: 不适用 ◎: Excellent ○: Good △: Worse ×: Not Used

滚齿加工 Hobbing

大批量生产型

- 加工时间短
- 工具费用低
- 复合加工机械上也能适用
- 只能加工外齿轮

For mass production

- Processing time is short
- Low tool cost
- Suitable to machining by combined processing machine
- Only for external gear

拉齿加工 Broaching

大批量生产型

- 加工时间短
- 运行维护费用低
- 初期投入费用高
- 只能加工内齿轮

For mass production

- Processing time is short
- Low tool cost in line production
- Initial tool cost is expensive
- Only for internal gear

插齿加工 Gear Shaper machining

小批量多品种生产型

- 可加工台阶、盲孔形状
- 外齿轮内齿轮皆可加工
- 加工时间长

For large item small scale production

- Suitable for stepped and blind hole shape
- Both internal gear and external gear can be machined
- Long machining time

旋刮(滚插)加工的适用范围

Usage of SKIVING process

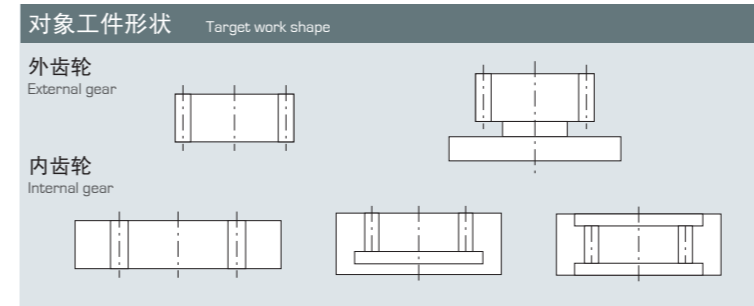


旋刮刀(滚插刀)的阵容

SKIVING cutter lineup

根据切削模拟采用合适的设计

Optimum cutter design by cutting simulation



使用设备对应各种类工件
Suitable for various work and equipment

使用设备 Machine

- 复合加工机(车削、加工中心)
- 旋刮加工专用机
- Combined processing machine (Turning machine, machining center)
- Special machine for skiving processing



适合旋刮(滚插)加工的特殊处理材料

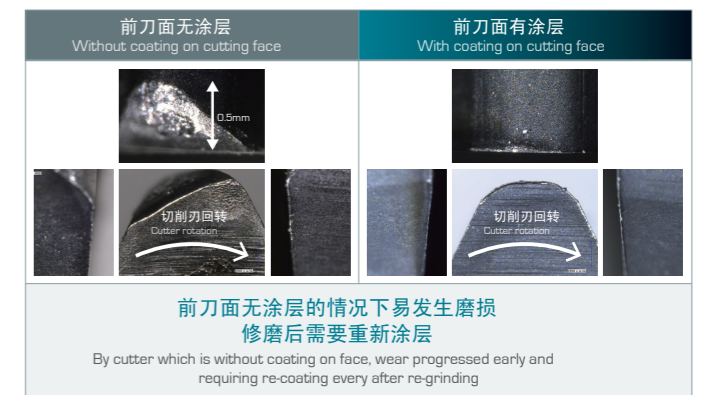
Optimal material specialized for skiving process

	FAX55	FAP2	FAXG1
耐磨耗性 Wear resistance	○	◎	◎+
耐热特性 Heat resistance property	○	○	◎
韧性 Toughness	○	◎	△
成本 Cost	○	△	△
注释 Note	低廉 Cheap	面向难切削材料 for difficult to machine material	面向一般材料 for general material

◎: 优秀 ○: 普通 △: 劣势 ◎: Excellent ○: Good △: Worse

适合旋刮(滚插)加工的表面处理

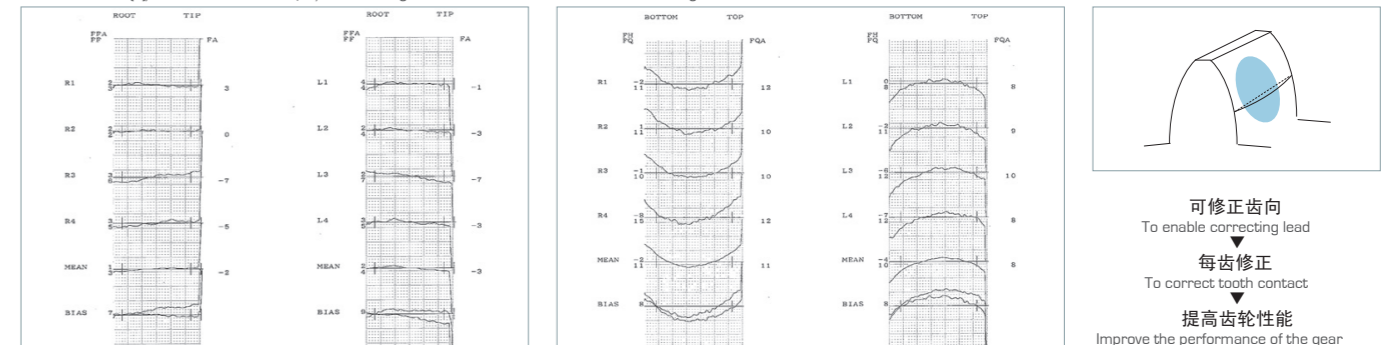
Optimal surface treatment of skiving process



旋刮(滚插)加工事例 内齿轮的加工精度

Processing Example by SKIVING CUTTER (Processing accuracy of Internal Gear)

齿形 加工时间: 90 (s) 齿形误差: 7μm (新JIS-6级) 齿向 鼓形加工
Profile Time: 90[s]/Tooth Profile Error: 7μm/New JIS 6 grade Tooth Lead Crowning



工件参数(内齿轮)
Work specifications (Internal gear)

mxPA		m1.5xPA20°
齿数	No. of teeth	内 70
螺旋角	Helix angle	20°RH
材质	Work material	SCM420
齿宽	Tooth width	25mm

刀具规格
Cutter specifications

齿数	No. of teeth	30
螺旋角	Helix angle	SPUR
材质	Cutter material	FAX55
涂层	Coating	Hyper DuAI GP 前刀面有涂层 With coating on cutting face

加工条件
Cutting conditions

刀具转速	Cutter rotation	粗/精 1600/1600 rpm
滑动速度	Sliding speed	148/148 m/min
进给量	Feed amount	0.05/0.05 mm/rev
切削油	Cutting oil	油性 Oiliness
交叉角	Crossed axis angle	20°