Week 5: Roland SRM-20 Group Project

Feed rate: the speed at which the cutter advances on the workpiece
- Usually expressed in inches or millimeters per revolution

Spindle speed: the rotational frequency of the spindle of the machine
- Expressed in revolutions per minute

Loadable workpiece weight: 2kg

Operating speed: 30 mm/s

Plunge rate: the speed at which the router bit is driven down into the material when starting a cut

Depth of cut: provides necessary depth of material that is required to remove by machining
- Expressed in mm
- usually given in the third perpendicular direction (Z-Direction)

Tooling:

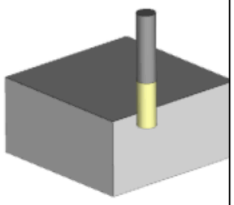
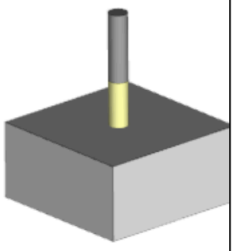
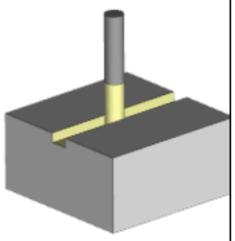
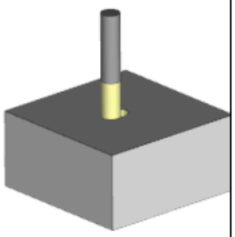
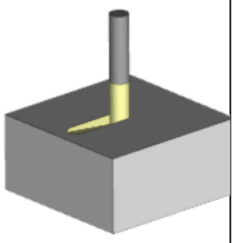
Roland SRM20 can use many different bits, ranging from 0.016” bits to 0.25” bits.
Flat end mills are mostly used for outline cuts because of their toughness and stiffness. Vcarve end mill is used for precise cuts that require smooth or really small trace cuts, unfortunately they are really fragile. Ball end mill is used mainly for having smooth circular shaped cuts from the material. Ball end mill can also be used in place of Vcarve end mill because unlike Flat end mill the thickness of Ball end mill increases as it goes deeper the material which gives the user different cut width.

End Mills
- Square end mill used for most general milling applications. Creates sharp edge at the bottom of pockets and slots

- Can either be center cutting and non-center cutting. Center cutting end mills on both the end face and sides. Needed for plunge milling. Non-center cutting end mills have cutting edges only on the sides. Used only for side milling.
- Roughing end mills have serrations in the teeth to remove large amounts of materials without much vibration.
- Ball end mills produce a radius at the bottom of pockets and slots. Used for contour milling, shallow slotting, and pocketing applications.

Flutes

- Spiral-shaped cutting edges on the sides of end mills to allow materials to escape when the mill is in a slot or pocket.
- Usually 2, 3, or 4 flutes
- More flutes, more cutting edges but less room for material to escape
- Number of flutes depends on your machine and materials. Less flutes are usually used for softer materials. More flutes cut harder material faster, but may cause issues with spacing for cut material to escape.

Side Milling	Face Milling	Slot Milling	Plunge Milling	Ramping
				
Machining of an edge surface on the part.	Machining of a top face on the part.	Machining between two edge surfaces.	Axial feeding into a part along the Z axis. Requires a center cutting end mill.	Axial feeding into a part along the Z axis as well as X or Y. Requires a center cutting end mill.

End Mill Materials

- High Speed Steel (HSS): Provides good wear resistance and costs less than cobalt or carbide end mills. HSS is used for general purpose milling of both ferrous and nonferrous materials. While usually inexpensive, HSS does not offer the tool life or speed advantages of cobalt and carbide end mills.
- Cobalt: Cobalt is an M42 tool steel with an 8% cobalt content. Cobalt is more expensive but provides better wear resistance and toughness than HSS (M7). Because the tool can run 10% faster than HSS, metal removal rates and finish are better than HSS.

- Solid Carbide: Carbide is considerably harder, more rigid, and more wear resistant than HSS. However, carbide is brittle and tends to chip instead of wear. Carbide is used primarily in finishing applications.

End Mill Coatings

- Standard coatings include Titanium Nitride (TiN), Titanium Carbonitride (TiCN), and Aluminum Titanium Nitride (AlTiN).
- Long-life TiN (titanium nitride) coating is good for use on alloy steel, aluminum, and plastic. Color is gold.
- Extra-life TiCN (titanium carbonitride) coating has better wear resistance than TiN coating, making it a good choice for tough-to-machine materials such as ductile cast iron, stainless steel, aluminum, and plastic. Color is blue-gray.
- Super-life AlTiN (aluminum titanium nitride) coating is the best for very high feeds/speeds and high-temperature applications. Used to mill cast iron, stainless steel, nickel-based alloys, and titanium. Not for use on aluminum. Color is purple-gray.

Part No.	Description	Price
EM-KIT-LR	Long Reach Tool Kit	$379.99
EM-KIT-SR	Short Reach Tool Kit	$143.99
EMB-125-2F-016	.016" Ball End Mill	$35.99
EMB-125-2F-016L	.016" Ball End, Mill Long	$38.99
EMB-125-2F-031	.031" Ball End Mill	$16.49

EMB-125-2F-031L	.031" Ball End Mill Long	$38.99
EMB-125-2F-063	.063" Ball End Mill	$16.49
EMB-125-2F-063L	.063" Ball End Mill Long	$38.99
EMB-125-2F-125	.125" Ball End Mill	$16.49
EMB-125-2F-125L	.125" Ball End Mill Long	$38.99
EMB-250-2F-250L	.250" Ball End Mill Long	$43.49
EMF-125-2F-016	.016" Flat End Mill	$27.99
EMF-125-2F-016L	.016" Flat End Mill Long	$38.99
EMF-125-2F-031	.031" Flat End Mill	$14.49

EMF-125-2F-031L	.031" Flat End Mill Long	$38.99
EMF-125-2F-063	.063" Flat End Mill	$14.49
EMF-125-2F-063L	.063" Flat End Mill Long	$38.99
EMF-125-2F-125	FLAT END MILL, .125" SHANK, 2 FLUTE, .125"TIP	$16.49
EMF-125-2F-125L	.125" Flat End Mill Long	$38.99
EMF-250-2F-250L	.250in Flat End Mill Long	$43.49
SM-20	SRM-20 Spindle Motor	$104.99
SS-20	SRM-20 Spindle Unit	$259.99
TAPE-MILLING	Double Sided Tape for Milling	$10.49
ZC-20-32	3.2mm- 1/8in SRM Collet	$64.99

ZC-23-635	Collet,1/4in(6.35mm)PNC-2300A/MDX-500	$35.99

Roland SRM20 specifications (Cuttable material/size, mechanical resolution, software, etc.)

MODEL	SRM-20
Cuttable Material	Modeling Wax, Chemical Wood, Foam, Acrylic, Poly acetate, ABS, PC board
X, Y, and Z Operation Strokes	8 (X) x 6 (Y) x 2.38 (Z) inches, 203.2 (X) x 152.4 (Y) x 60.5 (Z) mm
Workpiece table size	9.14 (X) x 6.17 (Y) inches, 232.2 (X) x 156.6 (Y) mm

Distance From Collet Tip to Table	Maximum, 5.15 in (130.75mm)
Loadable Workpiece Weight	4.4 lbs (2kg)
X-, Y-, and Z-Axis Drive System	Stepping motor
Operating Speed	0.24 – 70.87inch/min, 6 – 1800mm/min
Software Resolution	0.000039 inches/step (RML-1), 0.000039 inches/step (NC code), 0.01 mm/step (RML-1), 0.001mm/step (NC code)
Mechanical Resolution	0.0000393 inches/step, 0.000998594 mm/step

Spindle Motor	DC motor Type 380
Spindle Rotation Speed	Adjustable 3,000 – 7,000 rpm
Cutting Tool Chuck	Collet method
Interface	USB
Control Command Sets	RML-1, NC code
Power Requirements	Machine: DC24V, 2.5A, Dedicated AC adapter: AC 100-240V ±10%, 50/60Hz
Power Consumption	Approx. 50W

Operating Noise	During operation: 65 dB (A) or less (when not cutting), during standby: 45 dB (A) or less
External Dimensions	17.76 (W) x 16.80 (D) x 16.78 (H) inches, 451.0 (W) x 426.6 (D) x 426.2 (H) mm
Weight	43.2 lbs, 19.6 kg
Installation Environment	Temperature of 41 to 104 °F (5 to 40°C), 35 to 80% relative humidity (no condensation)
Included Items	USB cable, AC adapter, Power cord, Cutting tool, Collet, Set screw, Spanners (7,10mm / 0.28, 0.39 inches), Hexagonal wrench (size 2,3 mm / 0.059, 0.12 inches), Positioning pins, Double-sided tape, Start-up page guidance card

Software:

- Vpanel
    - Vpanel is a software for Roland SRM20 that allows users to interact directly with Roland SRM-20 Desktop mill and upload their job to the Roland SMR-20 desktop mill. This allows users with real time edits and control over Roland which can be really handy from time to time. Vpanel also allows different type of files other than ".rml".
- Mods
    - Mods is a website created by Neil. It's a multitool software that includes CAM software for multiple devices that can be used for a wide range of machines. It is an open source, fully editable software that gives users the ability to create many things for many machines or softwares.
- Flatcam
    - Flatcam is an open source PCB CAM tool. The compatible file types for Flatcam are gerber files, svg files, g-code, and excellon files. If you don't have a premade design, you can create one from scratch that will be exported for use in a milling machine.

VPanel for SRM-20	This is a dedicated software for controlling this machine. You operate this machine and make various settings using this software.
SRP Player	This is a CAM program that imports general-use 3D data, such as IGES, DXF (3D), or STL, and lets you easily prepare tool paths and output them to the SRM-20.
MODELA Player 4	
ClickMILL	This software is useful for post-cutting the material, for example, cutting the inner side of shapes ("pocket-cutting"), cutting out the material to the specified shape ("cutout"), or cutting the surface of the material to a uniform depth ("surface leveling").
iModela Creator	Used to create output data.

Virtual MODELA	This is a simulator that lets you check 3D previews of data before output. It also lets you check the estimated cutting completion time.
SFEdit2	SFEdit2 creates a stroke font by calculating center lines of characters of TrueType font or TrueType-based OpenType font.

Work Cited:

“Desktop Milling Machine: SRM-20 Accessories: Roland DGA.” *Roland Website*, www.rolanddga.com/products/3d/srm-20-small-milling-machine/accessories.

“MonoFab SRM-20 Compact Milling Machine.” *Roland Website*, www.rolanddga.com/products/3d/srm-20-small-milling-machine#specs.