Crafts/Technology

FASHIONING TECHNOLOGY

With “smart” materials, unorthodox assembly techniques, and the right tools, you can create accessories, home accents, and toys that light up, make sounds, or do even more. *Fashioning Technology* is an introductory DIY book that brings technology and crafts together in a fun and unique way. You get jargon-free primers and lots of how-to projects that will have you making—and even wearing—functional works of art.

Written for a broad audience, this book demonstrates how to blend sewing and assembly techniques with traditional electronics to build simple circuits using conductive thread, solder joints for snaps, and switches for buttons. With the sewing machine as a viable substitute for the soldering iron and an exciting array of smart materials at your disposal, you can craft a new generation of objects that are interactive, quirky, and fashion-conscious.

In *Fashioning Technology*, you’ll find:

- A wide range of projects, including electronic accessories, interactive plush toys, and color-changing blinds, all using diverse crafting techniques
- Techniques for seasoned crafters interested in incorporating simple electronics into their own projects
- Methods for makers proficient in electronics who are looking for unconventional ways to create novel projects

Each project encourages you to personalize and customize using your own designs, materials, and craft skills. *Fashioning Technology* translates traditional electronics into fun, fashionable interactive projects for the geek, fashionista, and craft aficionado alike. Now you really can be the flashiest dresser in town.

READY TO TAKE YOUR CRAFT PROJECTS TO THE NEXT LEVEL?

Learn Electronics
Make Wearables
Accent Your World
Create Interactive Toys

ROCK STAR HEADPHONES
LED BRACELET
PHOSPHORESCENT POWDER
SPACE INVADERS TOTE
GLAM THE GLO BUG

Craft: PROJECTS

Author Syuzi Pakhchyan, a seasoned artist, roboticist, and teacher, explains how to use smart materials such as thermochromatic and photochromatic inks that change color by touch or sunlight, magnetic and conductive paints, Polymorph plastic, fiber optics, and more.

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FASHIONING TECHNOLOGY
by Syuzi Pakhchyan

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proper use of equipment and safety gear, and determining whether you have adequate
skill and experience. Electricity and other resources used for these projects are dangerous
unless used properly and with adequate precautions, including safety gear. Some illustrative
photos do not depict safety precautions or equipment, in order to show the project steps
more clearly. These projects are not intended for use by children.

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FASHIONING TECHNOLOGY

A DIY Intro to Smart Crafting

By Syuzi Pakhchyan
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Electronic textiles are dramatically redefining the way circuits look and feel. The increasing availability of raw conductive materials such as inks, threads, and textiles opens a new world of possibilities to experiment with, to better help you craft electronics into fabric. Circuits can now be hand- or machine-sewn, woven, embroidered, inked, or knit; they can be lightweight, flexible, and even three-dimensional. But don’t throw your etchant solution and copper boards away quite yet, as it is difficult and time-consuming to sew complex circuitry by hand. For most projects, you will want to combine traditional printed circuit boards (PCBs) with soft circuits, controls, and switches. The following section introduces basic techniques on how to integrate electronics into textiles to get you started experimenting with soft circuits.
Conductive threads and textiles come with varying surface resistivity. Surface resistivity, typically measured in ohms per square, is the resistance of a material to the flow of electric current between opposite sides of its surface. In materials with low electrical resistance, electrons easily flow through or across the surface of the material. Generally, you will want to work with threads and textiles with low surface resistivity.

**NOTE:** There is a variety of conductive threads and textiles on the market that isn’t very conductive, meaning that they have high surface resistivity. Before purchasing any conductive thread or textile, it is important to check the product’s specifications to determine its surface resistivity.
Bookbinder's Knot

The bookbinder’s knot is a great needle-threading technique you can use for hand-stitching conductive paths and sewing electronic components. You will need a needle with an eye large enough to pass the conductive thread through. A needle threader comes in handy if you have difficulty threading the needle.

STEP 1: Snip the end of the conductive thread at a 45° angle to give the thread a sharp edge.

STEP 2: Hold the needle upright and push ½” of thread through the eye of needle.

STEP 3: From the opposite side of the needle, pull 2” of thread through the eye.

STEP 4: Hold the needle in a horizontal position and pierce the tip of the needle through the center of the thread’s fibers.

STEP 5: Using your thumb and forefingers, pull the pierced thread toward the eye of the needle.

STEP 6: Pull the other end of the thread taut until the knot is secure.

STEP 7: Knot the bottom of the thread.

WHAT YOU’LL NEED

» Needle
» Conductive thread
Sewing by Machine: The Perfect Stitch

» When sewing by machine, you will want to use a combination of conductive and regular sewing thread. Unless you’re using an industrial or commercial-grade sewing machine, always use the conductive thread as the bobbin thread and regular thread for the top thread. Also, use a needle suitable for medium to heavy-weight fabrics to prevent the needle from breaking.

The perfect machine-sewn conductive path will have the conductive thread isolated on the bottom side of the fabric, while the regular thread locks around the conductive thread and forms a stitch on the opposite side. The conductive thread should not be pulled through to the top of the fabric.

» Unlike traditional wire, conductive thread is not shielded. Any single fray in the thread can cause the circuit to misbehave or even short, especially if several conductive paths are sewn in proximity to one another. To make the perfect stitch, experiment with the different stitch settings on your machine. The results will also vary depending on the fabric you use. Once you have found a setting that works, write it down so that you will have a good starting point for the next project.

At the beginning and end of each conductive path, if both threads are on the same side of the fabric, tie a knot close to the stitch and trim the excess with scissors. You can use a touch of liquid seam sealant to ensure that the conductive thread doesn’t fray. If the two threads are on opposite sides, pull the top thread to the bottom of the fabric. Knot, trim, and use a seam sealant to prevent fraying.

If you will be sewing electronic components at the beginning or end of the conductive paths, leave at least 5”–6” of loose thread at the beginning or end of the path. Using the bookbinder’s knot, you can use the excess thread to sew the leads of the component directly to the path.

Sewing Components

Electronic components unfortunately aren’t manufactured in packages that readily lend themselves to sewing. Fortunately, most components do come with long, pliable leads that can be bent into loops to make hand-sewing possible.

Two tools that will come in handy when sewing electronic components are a sewing needle and a pair of needlenose pliers.
Sewing Components with Long Leads (LEDs, Resistors, Capacitors)

**STEP 1:** Using a sewing needle, pierce the fabric at the location where you want to place the leads.

**STEP 2:** Slip the leads of the component through the pierced holes to the opposite side of the fabric.

**STEP 3:** Using needlenose pliers, gently twist the leads around the tip of the pliers a few times, creating loops. Using the needlenose pliers, gently bend the loop flush to the fabric.

**STEP 4:** Using a needle with conductive thread, stitch around the loop several times, securing the loop to the fabric.

**STEP 5:** Once all the electronic components are sewn into the circuits and you have ensured that the circuit is working properly, you can add a touch of a liquid seam sealant to each component lead and over each sewn conductive path to ensure that the conductive thread doesn’t fray over time.

**WHAT YOU’LL NEED**

» Needle
» Conductive thread
» Component with long lead
» Fabric
» Liquid seam sealant
Sewing Integrated Circuit (IC) Chips

When sewing ICs, use a DIP (dual inline package) socket, a connector designed to hold IC chips. They are inexpensive and make it easier to address each individual lead without risking damaging the chip. Look for DIP sockets with long leads to make sewing easier.

STEP 1: Gently push the leads of the DIP socket through the fabric.

STEP 2: Using needlenose pliers, bend the leads flush to the fabric.

STEP 3: Using a needle with conductive thread, stitch around the first lead several times. Continue, and make a straight stitch about 2" in length. Repeat for all the leads, making sure that the conductive thread from each lead does not intersect or touch the conductive thread from the lead beside it.

STEP 4: Once all the leads are sewn, you can add a touch of a liquid seam sealant to each lead and accompanying conductive path, to ensure that the conductive thread doesn’t fray over time.
Sewing Components with Wires

» For components with wires (battery holders, piezo speakers, motors, and so on), you will first have to solder metallic loops to the end of each wire in order to sew them in place. You can use ordinary nickel-plated rounded or infinity-shaped eyes or similar metallic loops used in beading and jewelry making.

**STEP 1:** Strip about a ¼” of insulation from each wire. If the wire is stranded, using your thumb and forefinger, twist the strands together.

**STEP 2:** Loop the stripped end of each wire around the metallic loop.

**STEP 3:** Using a soldering iron, add a touch of solder.

**STEP 4:** Using a needle with conductive thread, stitch around the loop several times, securing it in place.

**WHAT YOU’LL NEED**

» Needle
» Conductive thread
» Component with wires
» Fabric
» Sewing eye fastener