Sierra Foothills Amateur Radio Club

http://www.sf-arc.org/ JULY 2010 PO BOX 1005. NEWCASTLE. CA

At the key of SFARC

S F A R C

OFFICERS

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Satellites: Greg, KO6TH
History: Gary, KQ6RT
Misc Radio: Fred, K6DGW
Sunshine: Richard WA6RWS
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916-482-5027

RESOURCES

REPEATERS
145.430 (-0.6 MHz/PL 162.2)
440.575 (+5.0 MHz/PL 94.8)
223.860 (-1.6 MHz/PL 100.0)
CLUB NET
Thursdays, 7:30PM, W6EK/R
145.430
CLUB MEETINGS
Second Friday of the month, 7:30PM at the Library, 350 Nevada St, Auburn CA
CLUB BREAKFAST
Last Sat of the month at Susie's Café, Cirby at Riversic Roseville – 8:00 AM
NET CONTROL OPS
Dave Jenkins, WB6RBE
Gary Cunningham, KQ6RT
Norm Medland, W6AFR
Casey McPartland, W7IB
NEWSLETTER EDITOR
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In this issue

Calendar of Events

August 21 — **SFARC CLUB PICNIC**
Auburn Recreation Park
123 Recreation Dr.
(Off Racetrack & Auburn Folsom Rd)

September 10 — "Breath California" Bike Trek
Operators needed (See page 5)

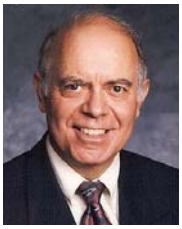
September 11 — **Third Annual Sacramento Valley Hamfest**
Lincoln High School
790 J St., Lincoln, CA
http://svhamfest.org/

SFARC CLUB MEETING

"Tech Ten" Presentation
"Temporary Antennas".

Don't miss this interesting presentation!
Bring a friend See you there!

We encourage members to receive Sierra Signals via email to save the Club the cost of reproduction and mailing



From the Presidents Shack

Al Martin, NI2U

President's Thoughts

By-Laws
The SFARC is categorized as a 501 (c)(3) by the IRS. Bob (KD6WTY) is proceeding to complete the registration with all of the proper California authorities. The Board voted unanimously to register for raffles. We have documentation for three years and have completed the Raffle Reports for those years. Once Bob turns in the forms, we should be to the point of understanding our liabilities dating back to 2001. More information will follow.

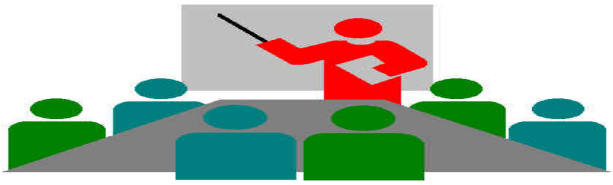
What is the SFARC?
The SFARC is what each individual wants. It is a place to exchange information on Amateur Radio. It is a place to learn or teach about electronics. It is a place to operate radio equipment and practice for an emergency. It is a place just to hang out and talk.

The SFARC is not a place that requires you to do anything except have an interest in radio. You can do as little or as much as you want.

Field Day
In order to obtain the Participation Pins and Hats orders will have to be placed as soon as the ARRL posts the memento information. The only pins available for us this year were the GOTA pins. Six were ordered and any remaining are usable for next year.

Next year the Pins and Hats order will go in, in April.

Club Picnic
Surprise, surprise the club picnic is set for August 14, 2010 at Recreation Park, Picnic-Rec 2. The reservation only includes food and soda. Recreation Park is off of Auburn-Folsom Road. I took a look at the facility which I reached off of Auburn-Folsom Road with a west turn traveling a ways to Recreation Drive. There is a lot of shade and a covered pavilion with eight tables. There is parking adjacent to the Pavilion. Looking forward to seeing you there!



SFARC BOARD MEETING MINUTES FOR Board Meeting Minutes June 11, 2010

Meeting started at 1730 hours at the round table Pizza in the Elm Ave. Shopping Center. Present were Pres. Al NI2U, V.P Chuck AE6LR, Secretary Bill W6WEM, Treasurer Bob KD6WTY, Director Gary KQ6RT, Director George KG6LSB, and Mary Anne KE6EST. Absent was Frank W6DHN.

Director Frank Sharit W6DHN tendered his resignation for personal and health reasons, Mary Anne Balthorpe KE6EST agreed to fill the position starting this meeting.

The By-Laws update is ready for release with the spelling and other corrections made. Life member definition and eligibility were finalized.

Field day planning was discussed.

The picnic was discussed and suggestions were made as to the location.

Chuck suggested we have member photos taken.

MISCELLANEOUS RADIO
Software Defined Radios - Filters

Last issue, we explored the rather straightforward subject of sampling the amplitude of an analog signal to produce a string of numbers, the "number soup." That's all the Digital Signal Processor [DSP] has to work with. With that continuous stream of numbers, it needs to filter, adjust levels, identify noise and suppress it, notch out unwanted carriers and signals, demodulate it to audio, equalize that audio, and deliver a new stream of numbers to the Digital-to-Analog Converter [DAC] that represent the time-varying amplitude of the audio signal headed for our headphones. Seems impossible at first glance, a single string of numbers is not much to work with, however after the ADC, we are in the magic world of mathematics, and mathematics can deal easily with things we have a hard time getting our heads around -- multiple dimensions, negative time, and even time running backward. But, this isn't a math club, so we'll stick to radios.

The reason the 2nd IF frequency of the K3 [and all other such radios] is low is because of computational limits. Remember that if we want to recreate a faithful analog reproduction of the sample number stream out of the DAC, we have to sample in the ADC at more than twice the rate of the highest frequency showing up at the input. We also need a fairly long word-length for the ADC [24-bits or more], and the combination of these requirements taxes the current computational ability of both ADC's and the DSP processors. So we design with a fairly low input frequency to the ADC, and in this case "fairly low" means in the very low KHz range which allows lower sampling rates.

What can we do with the "number soup?" In two words, a lot! Obviously, we can multiply each sample by a constant [expanding the amplitude of the output], or divide it by a constant [compressing the amplitude]. Not so very interesting but still useful. We can also delay the signal through the DSP. All we have to do is make each output number equal to the preceding input sample, and we've delayed the signal by one sample-time. And, there's nothing magic about 1-sample time, we can easily delay the signal as much as we want. The usefulness of that will appear later. However, one of the sexier things we can do is build filters – low pass filters, high pass filters, bandpass filters, notch filters – all done with mathematics and all work just like the filters we build with inductors, capacitors, crystals, and the like. Let's just skip forward to the fun part and build a bandpass filter. It is remarkably easy, and we can come back later to clean up the "What's this all mean?" stuff.

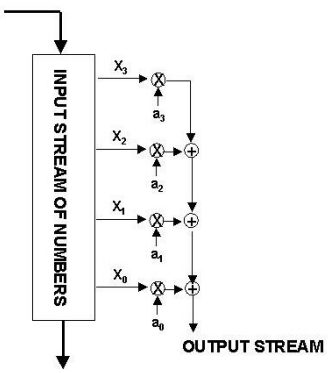


Fig 1 - 3rd Order FIR Filter

Figure 1 depicts a generalized 3rd order FIR filter. "Order" and "FIR" are some of the stuff we'll come back to. The stream of numbers from the ADC comes in at the top of the rectangle on the left. This is really just a push-down list in the DSP memory – each new number goes on top and pushes all the others down one slot – sort of like loading the plate holder at a buffet one plate at a time.

When four input numbers have been pushed onto the list, the first one in [we'll call it X_0] is multiplied by a constant [a_0], the second one in [X_1] is multiplied by a second constant [a_1], and so forth for the other two. The four products are then summed together, and we have produced the first output number from our filter.

Another number arrives from the ADC, pushes the list down one slot [the first number now falls off the bottom of the list], and the process repeats, giving us the second output number from our filter. This goes on forever. All we've done is convert one string of numbers into another.

"Ahhh," I hear you say, "But what kind of filter have we created?" The answer is, "It all depends on the values for a_0, a_1, a_2, and a_3." They're called "tap coefficients" and they're responsible for all the magic. How do we choose them? We'll come back to that too, as with a lot of magic, that's a bit more complex. But, assuming we have a way to choose them, we can build a low, high, or band pass filter, or a notch filter.

So, let's build a band pass filter with a width of 200Hz centered on 15 KHz, the K3's 2nd IF. This is a typical CW filter. I'm going to do this in Excel as I did for all the other stuff in this series. It turns out that to build a reasonable FIR band pass filter, 4 tap coefficients are nowhere near enough, so we'll build a 20th order filter, meaning there are 21 coefficients. It's just the same as the 3rd order filter, just "more of the same."

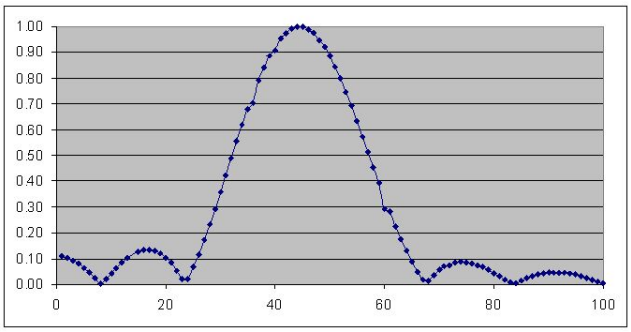
```
a[0]  = -1.5612864E-8
a[1]  =  4.1648705E-2
a[2]  =  7.1462420E-2
a[3]  =  5.9091065E-2
a[4]  =  1.1313934E-9
a[5]  = -7.4294830E-2
a[6]  = -1.1384963E-1
a[7]  = -8.5533900E-2
a[8]  = -5.5163927E-9
a[9]  =  9.1503990E-2
a[10] =  1.3048550E-1
a[11] =  9.1503990E-2
a[12] = -5.5163927E-9
a[13] = -8.5533900E-2
a[14] = -1.1384963E-1
a[15] = -7.4294830E-2
a[16] =  1.1313934E-9
a[17] =  5.9091065E-2
a[18] =  7.1462420E-2
a[19] =  4.1648705E-2
a[20] = -1.5612864E-8
```

These are the tap coefficients for our filter, and for the moment, please just take my word for that. Some are positive, some are negative, and they vary in magnitude. We would like our filter to have unity gain [that is, not change the signal level at the peak of the pass band], and that's what these coefficients will do since I specified unity gain in the design process. For those unfamiliar with scientific notation, the E±n just tells you which way and how many digits to move the decimal point, left for minus and right for plus. E-9 thus denotes a very small number.

So how can we tell if our filter works? Well, with some slightly involved mathematics we can calculate the shape of

the pass band, but there's a simpler way. If we feed our filter the number stream from a sampled sine wave of some frequency, the output stream will be that same frequency sine wave whose level depends on where in the pass band the frequency lies. We can do this for multiple frequencies just like feeding a signal generator into an electronic filter and measuring the output level at various frequencies.

I did this in the spreadsheet, running the frequency in 10 Hz steps around the 15 KHz center frequency, and kept track of the level at each frequency. The result is this plot.

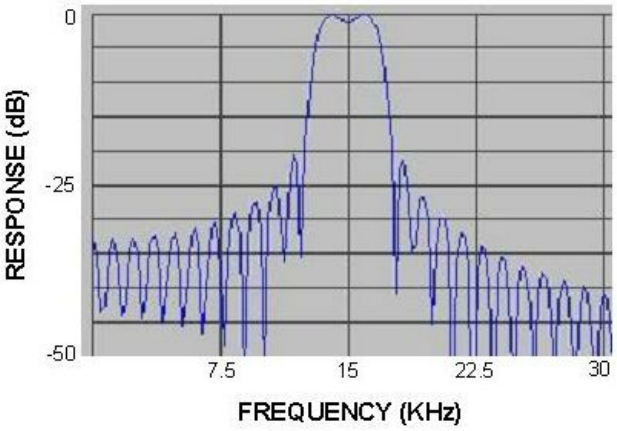


It's obvious that we have created a band pass filter, there's the central peak we expected. Note that the maximum of the pass band is 1.0, which is exactly what we wanted – unity gain. The frequency scale along the bottom runs from 14 KHz to 16 KHz.

The pass band is 200 Hz wide at the two points where the response is 6 dB down, just what we designed. Note however that there is some response well off the center frequency. This is a universal thing for FIR filters [and others as well]. That first response to the left of center corresponds to about 0.15 volts which is about 16.5 dB down. Our filter doesn't stack up so well with what we know crystal filters can do, and the reason is that even 21 coefficient taps aren't really enough in an FIR filter -- I just didn't want to build a bigger spreadsheet.

With higher order filters, the pass band will progressively flatten out, the sides will become progressively steeper, and those side responses will go down a little. The computational load on the processor will also go up dramatically. The filter at the top of the next column is a 100th order FIR filter, again centered on 15 KHz. This passband plot looks different because I used another program to plot the passband, I didn't want to build a spreadsheet with 101 coefficients☺. Note the central passband … it is flatter on top and the sides are steeper. The attenuation in the stopband is about 21 dB, not all that much better than our 20th order filter. [the frequency scale on this plot is much wider than above, our 20th order filter would have all those side responses too if I had carried the scale out as far].

The computational load of this filter is huge and DSP processors have some strange instructions that aren't found in more general purpose computers such as a PC or laptop.



Consider our 3rd order example from earlier. To calculate one tap on a general purpose computer, we have to fetch the input sample from the list and the coefficient, multiply them and store the product somewhere temporarily – fetch, fetch, multiply, store – four "operations." We have to do that a total of four times for 16 operations. Then we have to fetch two of the products from temporary storage, add them, fetch the next one add it, fetch the fourth one and add it, and then store our result somewhere – fetch, fetch, add, fetch, add, fetch, add, store – for 8 more operations. And, we have to do all 24 operations before the next input sample arrives. For the 100th order filter, we have to do the 4 operations 101 times plus add them all together for a total of 790 "operations" – all before the next sample-time.

This series of operations is extremely common in DSP programming, and DSP microprocessors have been designed to do one entire sequence as a single operation. On a PC, the 4-slot push-down list, if done with brute force programming would require fetching and storing four numbers to make room to store the next input sample. There are quicker ways to program that, but DSP processors actually put that entire sequence into hardware on the microprocessor chip. A single instruction will push everything down and put the new sample on the top [or at least that's how it looks to the programmer].

The important point of this issue's article is that once we have the stream of input numbers – the "number soup"-- we can modify that stream in many ways using just mathematics. In fact, at the level of the DSP, it's just arithmetic. The higher level mathematics all came as the concepts were being worked out, and when we design a specific filter. Next month we'll go back and visit some of the stuff we skipped over to get to our little filter.

73,

Fred K6DGW

Fifty Years Ago at SFARC
Gary Cunningham, KQ6RT
July 6, 1960

The regular Meeting of July 6, 1960 was called to order at 2030 by Jim Carman, President, outside the Home Ec. bldg. There were 10 members present, The Secretary's minutes were read and approved as *was* the Treasurer's report. The Treasurer reported a balance on hand of $85.6l.

A discussion was held relative to our meeting date after which Bob Davis made a motion that "By-Law section 2 be amended to read "SECOND Wednesday" instead of "FIRST Wednesday of each month". Frank Carman seconded the motion and it was passed unanimously. This will be the first amendment to our Constitution.

Mike Bauman paid $1.50 for dues, Jim Carman suggested looking into the possibility of getting another meeting place or getting a written agreement for the use of the present one. After a discussion Lin Hunter made a motion that we have a committee check into looking for a meeting place. Bob Davis seconded the motion. It was finally decided that everyone would be on the committee to check into getting a meeting place.

President Carman brought up the idea of having our own Field-Day Type meeting in the near future, and plan an outing for the event**.** Walt Dowdy is going to check to find out about a friend's cabin at Echo Lake.

The meeting adjourned at 2120 to go inside to refreshments of Soda and cookies and do-nuts.Respectfully submitted,

Richard H. Lund, Sec.

"Breath California" is looking for Ham Radio Operators for a 3 day bike Trek September 10, 11 and 12.

Don't miss this one of a kind bike trek, which raises money to support a good cause - clean air, healthy lungs and a tobacco-free future! The 24th Annual ETBT will take place September 10-12, 2010, in Petaluma running out of the KOA Campground. Operators will be taken care of and provided meals.

Operators will be riding in "SAG" vehicles to provide health & welfare for the riders. Equipment should be a 2 meter mobile with magnet mount antenna. **Hand held radios will not work for this event due to the terrain.**

If you are able to assist on any of the days it would be fine. The working days go from 8:00 AM to about 4:00 PM. If there are sufficient operators, the days will be shorter.

Please contact Dennis Bartoldo, N6PMI to get signed up or if you need more details 916-645-1609 or by e-mail, **dbart@garlic.com**

Thoughts for you about Band Edges
By Bill Costa, WV6J

I want to make my point about band edges. During the recent field-day at one point I monitored the top band edge of 20 meters. The Amateur community needs to be educated about these facts and I am sure a lot of you know this. I was shocked to hear pile-ups on the band edge at 14.348MHz. I guess a lot of hams don't understand how a HF signal isn't what the dial says (Display Frequency) during speech modulating the carrier. When you talk into the microphone the display frequency moves up during USB operation in accordance with the speech. This movement can be as much as three KHz. (according to the ARRL Handbook). This puts the dial readout actual frequency at 14.351 KHz. (97.301 out of band). All of the above applies to the side band in use. The opposite side band is a different story. Remember SSB = Single Side Band Suppressed Carrier. The carrier and unwanted sideband are still there but suppressed (97.307) but that is another topic for another day. I am sure we can get a lot deeper into this subject. I hope this makes my point.

Bill Costa WV6J

Club Meeting

Meeting started at 1833 hours followed by the pledge of allegiance, board and club member introductions.

Secretary report – Bill W6WEM reported on the board meeting minutes.

Treasurer report – Bob KD6WTY reported $1623.90 in the checking account

V.E report - -Casey W7IB reported 6 examiners, 8 tech tests(7 passed) and 2 Generals(2 passed).

Satellite report – Greg KO6TH reported that people should try satellite contacts on Field Day. Also reported on a deep space satellite from Japan that is like a sail.

Sunshine report – Bob WA6ULL was at home but returned to thr hospital with a temporal brain tumor. Best wishes to Bob and a speedy recovery.

Repeater report – Cabinets have been moved and secured to the wall and a key from the school district was obtained.

Tech Ten – Alan Bohnet KI6WDV showed his take apart 2 meter antennae he made for less than $10.00.

Old Business – The club's non-profit status is in the process of renewal with many government hoops to jump through.

New Business – Mary Anne Balthrope KE6EST will be filling Frank Sharits' W6DHN Directors' seat for the remained of the year. Jim Ki6Azh made a motion to spend no more than $600.00 for Field Day. Motion seconded by Gary KQ6RT and passed by majority vote. A suggestion was made to change the location of the monthly breakfast. Also a new member Burt Strong needs a ride to club meetings.

Chuck AE6LR made a presentation on Field Day.

Meeting adjourned at 2055 hours

ARRL VEC
AMATEUR RADIO VOLUNTEER EXAMINER

Local ARRL Exam Sessions
Courtesy of the ARRL

07/17/2010 | Carmichael CA 95608-6613

Sponsor: River City ARCS
Location: Carmichael Elks Lodge-Use East Entrance
Time: 7:00 AM (Walk-ins allowed)

08/21/2010 | Carmichael CA 95608-6613

Sponsor: River City ARCS
Location: Carmichael Elks Lodge-Use East Entrance
Time: 7:00 AM (Walk-ins allowed)

09/18/2010 | Carmichael CA 95608-6613

Sponsor: River City ARCS
Location: Carmichael Elks Lodge-Use East Entrance
Time: 7:00 AM (Walk-ins allowed)

10/16/2010 | Carmichael CA 95608-6613

Sponsor: River City ARCS
Location: Carmichael Elks Lodge-Use East Entrance
Time: 7:00 AM (Walk-ins allowed)

11/20/2010 | Carmichael CA 95608-6613

Sponsor: River City ARCS
Location: Carmichael Elks Lodge-Use East Entrance
Time: 7:00 AM (Walk-ins allowed)

12/18/2010 | Carmichael CA 95608-6613

Sponsor: River City ARCS
Location: Carmichael Elks Lodge-Use East Entrance
Time: 7:00 AM (Walk-ins allowed)

2010 FIELD DAY REPORT

By Chuck Baker AE6LR

The great weather for Field Day was just an indication of what was to come. All those who ventured out to Nyack had a great time. About ten or so people showed up by Friday afternoon to set up the site and some antennas.

Slingshots abounded and the trees sprouted with an abundance of antennas. The prize for the best antenna of this Field Day goes to Bob Naylor's desire to have a 160meter dipole. With the help of Alan Bohnet's slingshot abilities and the efforts of a host of others 240 feet of wire was strung with the feedline connection at the center being over 45 feet from the ground.

On Friday afternoon, using the 160meter antenna Bob Naylor got a 57 report from Portugal on twenty meters. On Friday night he got great reports from a number of stations on 160 meters. The antenna was also great on 40meters. This antenna could become a stable in the future.

We had a meeting with the participants Saturday morning at ten and then operations began at eleven. We started with a GOTA station, a VHF/UHF station, SSB on 20 and 40 meters, and a CW station. We also squeezed in some PSK31 during the day. The evening dinner was great as usual.

Joe and Dorothy came up from Nevada to visit our Field Day. We enjoyed their visit as well as the brownies they furnished.

Sunday proved to be as much fun as Saturday. A great time was had by all and a more detailed report will be given at the July meeting. Thanks for all the help making this Field Day a success.

Chuck Baker AE6LR