Group log 2020 02 17

TODO:

1. more interesting synthetic data

* + Non-constant alpha value:
    - piecewise constant ( large positive, small positive, large negative, small negative )
    - sawtooth ( ramp up and down )
    - sinusoidal
  + Non-constant radial value:
    - piecewise constant ( always positive values of course)

2. Modeling a new physical phenomenon: SHM

* Once it works, we can then SHM + non-aligned sensor: recover rotation parameter
* Synthetic data: x(t) varies sinusoidally, generate ax(t)
  + parameters A, omega, phi\_initial
  + metaparameters
    - delta\_t ; ensure period > 10\*delta\_t
* Local cost function
  + ci=ai-Acos(omega\*delta\_t\*i + phi\_initial )
* Windowed cost function
  + window size N
  + c = SUMN(ci\*\*2)
* Optimization
  + Start with N = 10; and with known value for phi and omega
    - ie. just optimize for A
  + multiple iterations at each window position-0)
* Rotation
  + Generate ax(t) as previously.
  + Apply a 2D rotation in x-y plane by angle theta
  + cost function first applies a rotation to (ax,ay)
  + then ci= SQR(ai-Acos(wt-phi)) + SQR(ay-0)
  + i.e. require ay=0 after rotation

3. Rotation problem for radial-parameter inference

* Recall that we rotate (ax,ay) by a trial angle phi yielding (ar,at). If angle phi results in ar negative, then our cost function fails because of the square-root operation.
* Solution: branching logic in the cost function
  + if ar<0, cost = CONST – ar
    - where ar is the undesired negative value
    - where CONST is the maximum value of the regular cost function
    - unclear how to anticipate value of CONST
* I need more time to think this one through before we implement!