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Subject: Hankel (Fourier-Bessel) Transform  
Posted by [Georg.Pabst](#) on Thu, 19 Jul 2001 17:53:46 GMT  
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Hi,

I'm looking for the Hankel (Fourier-Bessel) Transform, i.e.,  
 $\int_0^{\infty} f(t) \text{BesselJ}(t^*r) t \, dt$  being implemented in IDL.

There is a paper "Siegman A. 1980. Quasi fast Hankel transform. Opt. Lett. 1, 13-15" and one can also find the code in Fortran or C...

Thanks,  
Georg

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Subject: Re: Hankel (Fourier-Bessel) Transform  
Posted by [thompson](#) on Tue, 24 Jul 2001 19:15:17 GMT  
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Georg.Pabst@nrc.ca (Georg Pabst) writes:

> Hi,

> I'm looking for the Hankel (Fourier-Bessel) Transform, i.e.,  
>  $\int_0^{\infty} f(t) \text{BesselJ}(t^*r) t \, dt$  being implemented in IDL.

> There is a paper "Siegman A. 1980. Quasi fast Hankel transform. Opt. Lett. 1, 13-15" and one can also find the code in Fortran or C...

> Thanks,  
> Georg

Here's an old program that I think might be what you need.

Bill Thompson

```
FUNCTION HANKEL,F
;
; This function returns the Hankel transform of the argument.
;
S = SIZE(F)
IF S(0) NE 1 THEN BEGIN
  PRINT,'*** Variable must be a one-dimensional array, name= F, routine HANKEL.'
  RETURN,F
ENDIF
```

```
;
X = INDGEN(F)
K = ( 2. * !PI / FLOAT(N_ELEMENTS(X)) ) * X
SC = 0.*X + 1.
IF N_ELEMENTS(SC) GT 3 THEN BEGIN
  SC(0) = 3.D0 / 8.D0
  SC(1) = 7.D0 / 6.D0
  SC(2) = 23.D0 / 24.D0
ENDIF
;
H = BES0( K # X ) # ( K * F * SC )
;
RETURN,H
END
```

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Subject: Re: Hankel (Fourier-Bessel) Transform  
 Posted by [Craig Markwardt](#) on Tue, 24 Jul 2001 19:46:37 GMT  
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thompson@orpheus.nascom.nasa.gov (William Thompson) writes:

```
...
> H = BES0( K # X ) # ( K * F * SC )
```

Ahh, matrix product, very clever. :-)

Just a note to Georg, this will probably get the job done, but bear in mind that it is a memory-cruncher. The same thing can be done with the discrete fourier transform.

Craig

--

-----  
 Craig B. Markwardt, Ph.D.      EMAIL:    craigmnet@cow.physics.wisc.edu  
 Astrophysics, IDL, Finance, Derivatives | Remove "net" for better response  
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Subject: Re: Hankel (Fourier-Bessel) Transform  
 Posted by [Georg.Pabst](#) on Wed, 25 Jul 2001 17:23:29 GMT  
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Craig Markwardt <craigmnet@cow.physics.wisc.edu> wrote in message  
 news:<onitgigleq.fsf@cow.physics.wisc.edu>...

```
> thompson@orpheus.nascom.nasa.gov (William Thompson) writes:
> ...
```

```
>> H = BES0( K # X ) # ( K * F * SC )
>
> Ahh, matrix product, very clever. :-)
>
> Just a note to Georg, this will probably get the job done, but bear in
> mind that it is a memory-cruncher. The same thing can be done with
> the discrete fourier transform.
>
> Craig
```

Thanks for the help. Thanks to the mail of Brian Borchers I could translate a Matlab package (<http://www.nmt.edu/~borchers/hankel.html>) into IDL, which seems to do exactly what I want. So in case anyone else is interested in Hankel transforms...give me a shout....

Georg

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Subject: Re: Hankel (Fourier-Bessel) Transform  
Posted by on Wed, 26 Mar 2014 16:25:06 GMT  
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Den tisdagen den 24:e juli 2001 kl. 21:03:48 UTC+2 skrev William Thompson:

```
> Georg.Pabst@nrc.ca (Georg Pabst) writes:
>
>> Hi,
>
>> I'm looking for the Hankel (Fourier-Bessel) Transform, i.e.,
>> int(0,infinity) f(t)*BesselJ(t*r)t dt being implemented in IDL.
>
>> There is a paper "Siegman A. 1980. Quasi fast Hankel transform. Opt.
>> Lett. 1, 13-15" and one can also find the code in Fortran or C...
>
>> Thanks,
>> Georg
>
> Here's an old program that I think might be what you need.
>
> Bill Thompson
>
>
> FUNCTION HANKEL,F
> ;
> ; This function returns the Hankel transform of the argument.
> ;
```

```

> S = SIZE(F)
> IF S(0) NE 1 THEN BEGIN
>   PRINT, '*** Variable must be a one-dimensional array, name= F, routine HANKEL.'
>   RETURN, F
> ENDIF
> ;
> X = INDGEN(F)
> K = ( 2. * !PI / FLOAT(N_ELEMENTS(X)) ) * X
> SC = 0.*X + 1.
> IF N_ELEMENTS(SC) GT 3 THEN BEGIN
>   SC(0) = 3.D0 / 8.D0
>   SC(1) = 7.D0 / 6.D0
>   SC(2) = 23.D0 / 24.D0
> ENDIF
> ;
> H = BES0( K # X ) # ( K * F * SC )
> ;
> RETURN, H
> END

```

So this thread is from 2001 but it is all I found by googling for "Hankel transform IDL"...

I tried to use the HANKEL function given above but I couldn't make it work. The `X=INDGEN(F)` makes no sense to me. Should it be `X=INDGEN(n_elements(F))`? I tried that and as I can't find the `BES0` function, I substituted `beselj(K # X, 0)`. This gave me some output, but it completely failed my test of using the same function to compute the inverse Hankel transform and thus getting the original function back. So maybe my changes were all wrong.

So, does anyone know of a useful implementation for IDL? Or C? I just want to convolve some circularly symmetrical functions, but I want to do it as part of a model fitting problem so it would be great if I could save some time by not doing 2D FFTs.

In a response to the post above, Craig commented that it can be done with the discrete Fourier transform. That sounds easy. Is it?

---

Subject: Re: Hankel (Fourier-Bessel) Transform

Posted by on Thu, 27 Mar 2014 15:12:11 GMT

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Den onsdagen den 26:e mars 2014 kl. 17:25:06 UTC+1 skrev Mats Löfdahl:

> Den tisdagen den 24:e juli 2001 kl. 21:03:48 UTC+2 skrev William Thompson:

>

>> Georg.Pabst@nrc.ca (Georg Pabst) writes:

>

>>

>

>>> Hi,

```

>
>>
>
>>> I'm looking for the Hankel (Fourier-Bessel) Transform, i.e.,
>
>>>  $\int_0^{\infty} f(t) \cdot \text{BesselJ}(t \cdot r) \cdot t \, dt$  being implemented in IDL.
>
>>
>
>>> There is a paper "Siegman A. 1980. Quasi fast Hankel transform. Opt.
>
>>> Lett. 1, 13-15" and one can also find the code in Fortran or C...
>
>>
>
>>> Thanks,
>
>>> Georg
>
>>
>
>> Here's an old program that I think might be what you need.
>
>>
>
>> Bill Thompson
>
>>
>
>>
>
>>
>
>> FUNCTION HANKEL,F
>
>> ;
>
>> ; This function returns the Hankel transform of the argument.
>
>> ;
>
>> S = SIZE(F)
>
>> IF S(0) NE 1 THEN BEGIN
>
>> PRINT,'*** Variable must be a one-dimensional array, name= F, routine HANKEL.'
>
>> RETURN,F

```

```

>
>> ENDIF
>
>> ;
>
>> X = INDGEN(F)
>
>> K = ( 2. * !PI / FLOAT(N_ELEMENTS(X)) ) * X
>
>> SC = 0.*X + 1.
>
>> IF N_ELEMENTS(SC) GT 3 THEN BEGIN
>
>> SC(0) = 3.D0 / 8.D0
>
>> SC(1) = 7.D0 / 6.D0
>
>> SC(2) = 23.D0 / 24.D0
>
>> ENDIF
>
>> ;
>
>> H = BES0( K # X ) # ( K * F * SC )
>
>> ;
>
>> RETURN,H
>
>> END
>
>
>

```

> So this thread is from 2001 but it is all I found by googling for "Hankel transform IDL"...

I've spent some time trying to understand various matlab codes for calculating Hankel transforms but they seem to require the function to be sampled at some exponential sampling. I need a code that you can call like the `fft()`, with equidistant sampling.

The OP was happy with porting a matlab code found at [www.nmt.edu/~borchers/hankel.html](http://www.nmt.edu/~borchers/hankel.html), but that is a code that requires the name of a function that it then evaluates at points of its own choosing. It does not solve my problem.

> I tried to use the HANKEL function given above but I couldn't make it work. The `X=INDGEN(F)` makes no sense to me. Should it be `X=INDGEN(n_elements(F))`?

To be specific, `X=INDGEN(F)`, where `F` is the input function. How is that supposed to work? IDL will accept a vector of dimension lengths, but that vector must be shorter than 8 elements and

should anyway consist of integers > 0. That seems like rather limiting requirements.

> I tried that and as I can't find the BES0 function, I substituted beselj(K # X, 0). This gave me some output, but it completely failed my test of using the same function to compute the inverse Hankel transform and thus getting the original function back. So maybe my changes were all wrong.

Here is one test that demonstrates that the transform of the transform does not return the original function (not even times some constant - that would be OK of course):

```
r = findgen(101)/100.
```

```
f = r^3
```

```
h = hankel(f)
```

```
hh = hankel(h)
```

```
cgplot, r, hh, color = 'red'
```

```
cgplot, r, f, /over, color = 'blue'
```

But that is with my edits. Here is the edited function:

```
FUNCTION HANKEL,F
```

```
;  
;  
; This function returns the Hankel transform of the argument.  
;  
;  
  S = SIZE(F)  
  IF S(0) NE 1 THEN BEGIN  
    PRINT,'*** Variable must be a one-dimensional array, name= F, routine HANKEL.'  
    RETURN,F  
  ENDIF  
;  
;X = INDGEN(F)  
X = INDGEN(n_elements(F))  
K = ( 2. * !PI / FLOAT(N_ELEMENTS(X)) ) * X  
SC = 0.*X + 1.  
IF N_ELEMENTS(SC) GT 3 THEN BEGIN  
  SC(0) = 3.D0 / 8.D0  
  SC(1) = 7.D0 / 6.D0  
  SC(2) = 23.D0 / 24.D0  
ENDIF  
;  
;  
; H = BES0( K # X ) # ( K * F * SC )  
H = beselj( K # X, 0 ) # ( K * F * SC )  
;  
;  
  RETURN,H  
END
```

> So, does anyone know of a useful implementation for IDL? Or C?

Nothing? How about FORTRAN?

> In a response to the post above, Craig commented that it can be done with the discrete Fourier transform. That sounds easy. Is it?

One of the matlab functions I found does this. But it won't let me choose my own sampling points.

---

---

Subject: Re: Hankel (Fourier-Bessel) Transform  
Posted by [Helder Marchetto](#) on Thu, 27 Mar 2014 15:41:36 GMT  
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>> So, does anyone know of a useful implementation for IDL? Or C?  
>  
> Nothing? How about FORTRAN?

Hi Mats,  
if you look in wiki, you will find lots of references at the bottom. Most of them are articles, but (at least) one of these leads to a fortran implementation by Thomas Wieder. You can get it here:  
<http://homepages.tu-darmstadt.de/~wieder/hankel/hankel.f>  
or here the page where the link is from:  
<http://homepages.tu-darmstadt.de/~wieder/hankel/hankel.html>

I hope it helps...

Regards,  
Helder

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Subject: Re: Hankel (Fourier-Bessel) Transform  
Posted by on Thu, 27 Mar 2014 17:24:25 GMT  
[View Forum Message](#) <> [Reply to Message](#)

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Den torsdagen den 27:e mars 2014 kl. 16:41:36 UTC+1 skrev Helder:  
>  
> <http://homepages.tu-darmstadt.de/~wieder/hankel/hankel.html>

Yes, this looks useful! Thanks.

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